DEPARTMENT OF THE ARMY TECHNICAL MANUAL **TM 5-6116-293-35**

DEPARTMENT Of THE AIR FORCE TECHNICAL ORDER - **TO 35C2-3-329-22**

FIELD AND DEPOT MAINTENANCE MANUAL

GENERATOR SET, DIESEL ENGINE PRECISE POWER; 100 KW, AC, 120/208 V, 240/416 V, 3 PHASE, 60 CYCLE AT 1800 RPM, 83.3 KW, 120/208 V 240/416 V, 3 PHASE, 50 CYCLE AT 1500 RPM; SKID MOUNTED (DETROIT DIESEL DIVN. GENERAL MOTORS CORP. MODEL 6910A) FSN 6115-798-3444

DEPARTMENTS OF THE ARMY AND THE AIR FORCE
JULY 1961

SAFETY PRECAUTIONS

When a malfunction of the selenium rectifier occurs, thoroughly ventilate the area to prevent inhalation of poisonous fumes. Do not handle the damaged selenium rectifier without gloves. Selenium oxide may be absorbed through the skin, especially when the selenium rectifier is hot. Failure to observe this warning can result in severe illness or death.

The voltage of the generator set is dangerous to persons coming into contact with any part carrying electrical current while the unit is operating. Unless instructed otherwise, do not make adjustments or changes in wiring or any part of the unit while it is operating. Make certain it is not connected to any other generator or electrical power source.

Exercise extreme care in the use of test lamp circuits of 110 volts or higher. Injury or possible death by electrocution can result from contact with the test lamp circuit.

When testing the fuel injectors for spray characteristics, keep hands away from the nozzle spray. The high velocity spray may puncture the skin and cause blood poisoning.

Fill the fuel tank with water before soldering or brazing to keep tank from exploding. Failure to observe this warning may result in serious injury to personnel.

TECHNICAL MANUAL
No. 5-6115-293-35
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DEPARTMENTS OF THE ARMY
AND THE AIR FORCE

WASHINGTON 25, D.C., *15 July 1961*

Field and Depot Maintenance Manual

GENERATOR SET, DIESEL ENGINE: PRECISE POWER; 100 KW, AC, 120/208 V, 240/416 V, 3 PHASE, 60 CYCLE, AT 1800 RPM, 83.3 KW, 120/208 V, 240/416 V, 3 PHASE, 50 CYCLE AT 1500 RPM; SKID MOUNTED (DETROIT DIESEL DIVN. GENERAL MOTORS CORP. MODEL 6910A) FSN 6115-798-3444

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual covers the General Motors Detroit Diesel Engine Division Generator Sets, Models 6910 and 6910A. It provides information on the maintenance of the equipment which is beyond the scope of the tools, equipment, personnel, or supplies normally available to using organizations.

b. The appendix contains a list of all publications referenced in the text. Appendix II of TM 5-6115-293-12 contains the Maintenance Allocation Chart. The list of repair parts and special tools required by field and depot maintenance facilities for support of this equipment is contained in TM 5-6115-293-35P.

c. The numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

d. Report all deficiencies in this manual on DA Form 2028. Submit recommendations for changes, additions, or deletions to the Commanding General, Military Construction Supply Agency/U. S. Army Engineer Maintenance Center, Corps of Engineers, P. O. Box 119, Columbus 16, Ohio, ATTN: EMCDM. Direct communication is authorized.

2. Record and Report Forms

For record and report forms applicable to third, fourth, and fifth echelons of maintenance, refer to TM 5505, Maintenance of Engineer Equipment.

Section II. DESCRIPTION AND DATA

3. Description

For a complete description of the generator set, refer to TM 5-6115-293-12.

4. Tabulated Data

a. Generator Classification and Rating.

Voltage rating	120/208/240/416 ac (alternating current)
Phase 3	3
Kw (kilowatt) rating at 60 cycle	100
Kw rating at 50 cycle	83.3
Kva (kilovolt-ampere) rating at 60 cycles	125
Kva rating at 50 cycles	104
Rpm (revolutions per minute) at 60 cycles	1,800
Rpm at 60 cycles	1,500
Amperes at 120/208 volts and 60 cycles	347
Amperes at 240/416 volts and 60 cycles	173.5
Amperes at 120/208 volts and 50 cycles	289
Amperes at 240/416 volts 50 cycles	144.5
Exciter volts, dc (direct current)	45
Excitation amperes	27
Duty classification	Continuous
Degree of enclosure	Full
Cooling	Fan
Drive	Direct
Type lubrication	Sealed bearing
Power factor	80 percent

b. Engine.

Manufacturer	Detroit Diesel Division of General Motors Corp.
Type	Diesel
Model	6910 and 6910A
Series	6-71
Cooling	Liquid
Number of cylinders	6
Cycle	2
Bore	4.25 in. (inch)
Stroke	5 in.
Piston displacement	425 cu in. (cubic inch)
Compression ratio	17 to 1
Firing order	1-5-3-6-2-4

Crankshaft rotation .....counterclockwise
(View from generator end)
Governed speed .....1,500 and 1,800 rpm

c. Fuel Transfer Pump.

Manufacturer .....TUT Hill Corp.
Model 00L35
Type .....Direct drive

d. Governor.

Manufacturer .....Woodward Governor Company
Part number 375351
Model LSG-1
Type .....Hydraulic load sensing

e. Overspeed Governor.

Manufacturer .....Synchro Start Products, Inc.
Model GW-2
Governor speed .....1,800 to 2,100 rpm

f. Circulation Pump.

Manufacturer .....Robins and Myers Company
Model .....GM 20124
Volts 24
Serial .....C 18 LS

g. Governor Computer.

Manufacturer .....Woodward Governor Company
Volts 208
Cycle 50-60
Part number 379002

h. Static Exciter.

Manufacturer .....Delco-Remy Division of General Motors Corp.
Part number, Model 6910 5548841
Part number, Model 6910A 6.....5550468

i. Voltage Regulator.

Manufacturer .....Delco-Remy Division of General Motors Corp.
Part number, Model 6910 5548842
Part number, Model 6910A 5551983

j. Coolant Heater.

Manufacturer .....Perfection Industries
Model E-511
Volts 24
Fuel .....Gasoline
Output .....60,000 Btu (British thermal unit) per hr (hour)
Fuel consumption:
Hi-fire .....0.75 gph (gallons per hour)
Lo-fire .....0.5 gph

k. Engine Repair and Replacement Standards. Table I lists manufacturer's sizes, tolerances, clearances, and the maximum allowable wear and clearance.

Table I. Engine Repair and Replacement Standards

	Manufacturer's dimensions and tolerance in inches		Desired clearance		Maximum allowable wear in inches	Maximum allowable clearance in inches
	Min	Max	Min	Max		
Cylinder Block						
Block bore:						
Diameter	4.6265	4.6275			4.628	
Out-of-round		0.001			0.003	
Taper		0.001			0.002	
Cylinder linear counterbore:						
Diameter	5.046	5.0485				
Depth	0.4785	0.4795				
Main bearing bore:						
Inside diameter	3.812	3.813				
Cylinder Liners						
Outside diameter	4.6250	4.6260				
Inside diameter	4.2495	4.2505				
Flange diameter	4.776	4.766				
Liner-to-block bore clearance	0.0005	0.0025				0.008
Liner inside diameter out-of-round		0.002			0.003	
Liner inside diameter taper		0.001			0.002	
Depth of liner flange below block	0.0465	0.050			0.050	
Crankshaft						
Main bearing journal diameter.	3.499	3.5000				
Connecting rod journal diameter	2.749	2.750				
Journal out-of-round		0.00025			0.003	

Table I. Engine Repair and Replacement Standards-Continued

	Manufacturer's dimensions and tolerance in inches		Desired clearance		Maximum allowable wear in inches	Maximum allowable clearance in inches
	Min	Max	Min	Max		
Crankshaft-Continued						
Journal taper		0.0005			0.003	
Total indicator reading runout:						
at No. 2 and No. 6 journals		0.002*			0.002*	
at No. 3 and No. 5 journals		0.004*			0.004*	
at No. 4 journal		0.006*			0.006*	
Thrust washer thickness	0.1205	0.1220				
End thrust clearance	0.004	0.011				0.018
Main Bearings						
Bearing inside diameter	3.502	3.504				
Bearing-to-journal clearance	0.0014	0.0044				0.006
Bearing thickness, 90° from parting line	0.1545	0.1550			0.153	
Cam Followers						
Diameter	1.060	1.061				
Bore-in-head	0.062	0.063				
Follower-to-head clearance	0.001	0.003				0.006
Width of roller slot	0.5635	0.564				
Roller pin hole diameter	0.4362	0.437				
Cam Follower Roller and Pins						
Roller outside diameter	0.905	0.907				
Roller bushing inside diameter	0.4385	0.4390				
Support-to-end plate	0.0005 press	0.0025 free				
Blower Drive Gear Hub						
At bushing diameter	1.624	1.6250				
Hub-to-support bearing clearance	0.001	0.0025				
Hub-to-cam clearance	0.992	0.996				
End thrust	0.005	0.008				
Idler Gear						
Backlash	0.003	0.008				0.008
Hub outside diameter	2.6252	2.6257				
Gear-to-hub	0.0000	0.0005 press				
Camshaft and Balance						
Shaft gear:						
Backlash	0.003	0.008				0.008
Roller pin outside dimensions	0.4375	0.4377				
Pin-to-bushing clearance	0.0008	0.0015				
Bushing-to-roller (press fit)	0.0025	0.004				
Roller-in-follower end play	0.0145	0.018				
Pistons						
Diameter:						
At top	4.219	4.222				
At ring lands	4.235	4.238				
At skirt (below compression ring groove to bottom)	4.2433	4.2455				
Clearance:						
Top of skirt	0.004	0.0072				0.009
Bottom of skirt	0.004	0.0072				0.009
Out-of-round		0.0005				
Taper		0.0005				
Ring groove width:						
Upper compression ring.	0.134	0.136				
2d compression ring	0.132	0.134				

* When runout on adjacent journals is in the opposite direction, the sum must not exceed 0.003 total indicator reading. When runout on adjacent journals is the same direction. the difference must not exceed 0.003 total indicator reading.

Table I. Engine Repair and Replacement Standards-Continued

	Manufacturer's dimensions and tolerance in inches		Desired clearance		Maximum allowable wear in inches	Maximum allowable clearance in inches
	Min	Max	Min	Max		
Pistons-Continued						
3d and 4th compression rings	0.130	0.132				
Oil ring	0.1875	0.1895				
Piston Pin Bushing Diameter						
Inside	1.5025	1.5030				
Outside	1.7540	1.7555				
Piston Pins						
Diameter	1.4996	1.5000				
Pin-to-piston bushing clearance	0.0025	0.0034				0.010
Pin-to-rod bushing clearance	0.0015	0.0024				0.010
Length	3.610	3.620				
Pin-to-retainer end clearance	0.016	0.004				0.064
Piston Rings						
Compression rings:						
Gap:						
"Chrome" rings	0.026	0.040				0.050
Standard rings	0.025	0.035				0.045
Ring-to-groove clearance:						
Top (No. 1)	0.010	0.0125				0.022
No. 2	0.008	0.0105				0.015
No. 3, No. 4	0.006	0.0085				0.013
Oil rings:						
Gap	0.010	0.020				0.040
Ring-to-groove clearance	0.0015	0.0055				0.008
Connecting Rods						
Center-to-center length	10.124	10.126				
Diameter lower bore	3.062	3.063				
Diameter upper bore	1.7490	1.7510				
Upper bushing diameter	1.5015	1.5020				
Normal rod end thrust	0.006	0.012				
Connecting Rod Bearings						
Bearing inside diameter	2.762	2.754				
Bearing clearance	0.0014	0.0044				0.006
Bearing thickness, 900 from parting line	0.1545	0.1550			0.153	
Timing Gears						
Blower drive gear:						
Backlash	0.003	0.008				0.008
Gear-to-hub fit	0.0005 press	0.001 free				
Blower drive gear support:						
Support bearings inside diameter	1.6260	1.6265				
Bearing-to-hub clearance	0.001	0.0025				
Gear inside diameter	1.186	1.187				
Gear-to-shaft	0.0000	0.0015 press				
Camshaft						
Shaft diameter, at bearings:						
Front and rear	1.4975	1.497				
Center and intermediate	1.4985	1.498				
Runout at center bearing (when mounted on end bearings):						
End thrust	0.004	0.011				0.018
Thrust washer thickness	0.120	0.122				

Table I. Engine Repair and Replacement Standards-Continued

	Manufacturer's dimensions and tolerance in inches		Desired clearance		Maximum allowable wear in inches	Maximum allowable clearance in inches
	Min	Max	Min	Max		
Camshaft and Balancer Shaft Bearings						
Inside diameter:						
Front and rear	1.500	1.501				
Center and intermediate	1.501	1.503				
Bearings-to-shaft clearance:						
Front and rear	0.0015	0.003	.			0.006
Center and intermediate	0.0025	0.005	..			0.008
Outside diameter of bearings:						
Front and rear	2.1880	2.1885				
Intermediate	2.184	2.186				
Diameter of block bore	2.1875	2.1885				
Bearings-to-block clearance:						
Front and rear	0.001	0.0005 Tight	loose			
Intermediate	0.0015	0.0045				
Balancer Shaft						
Shaft diameter at bearings	1.4970	1.4975				
Shaft-to-bearings clearance	0.0025	0.005	.			0.008
End thrust	0.004	0.011				0.018
Thrust washer thickness	0.120	0.122				
Cylinder Head						
Cam follower bore	1.062	1.063				
Exhaust valve seat insert counterbore:						
Diameter	1.626	1.627				
Depth	0.375	0.380				
Valve Seat Inserts						
Exhaust valve seat angle	30^{o}	30^{o}			30^{o}	
Exhaust valve seat width	1/16	3/22	.		3/32	
Valve seat runout	...	0.002	.		0.002	
Diameter of seat counterbore in head	1.626	1.627				
Depth of seat counterbore in head	0.375	0.380				
Valve head-to-cylinder head	0.005	0.017	.		0.040	
Exhaust Valve						
Diameter of head	1.569	1.559				
Stem diameter	0.3415	0.3425				
Valve clearance (HOT)	0.009	0.009	.			0.009
Valve Guides						
Height above cylinder head	1 19/32	1 19/32				
Inside diameter	0.3445	0.3455				
Stem-to-guide clearance	0.002	0.004	.			0.006
Rocker Arms and Shafts						
Rocker shaft diameter	0.8735	0.8740				
Rocker arm shaft bushing inside diameter	0.8750	0.8760				
Shaft-to-bushing clearance	0.001	0.0025				
Rocker arm outer bushing inside diameter	0.564	0.565				
Rocker arm inner bushing outside diameter	0.562	0.5625				
Outer-to-inner bushing clearance	0.0015	0.003				
Rocker arm inner bushing inside diameter	0.4375	0.4385				
Push rod clevis pin outside diameter	0.4380	0.4385				
Pin-to-bushing clearance	0.001	0.0005 tight	loose			
Push rod clevis inside diameter	0.4370	0.4385				
Pin-to-clevis clearance	0.0015	0.0005 tight	loose			
Clevis-to-rocker arm end play	0.007	0.013				

l. Nut and Bolt Torque Data.

	Size	Torque (ft-lb)
Cam follower guide bolt	¼-20	12-15
Blower rotor gear to-hub-bolt	5/16-24	25-30
Cam and balancer end bearing bolt	3/8-16	35-40
Balancer weight cover	3/8-16 & 24	26-30
Flywheel housing	3/8-16 & 24	26-30
Front cover (crankshaft)	5/8-16 & 24	26-30
Blower drive gear	3/8-24	26-30
Accessory drive bolt	3/8-24	20-25
Blower-to-cylinder block	7/16-14	55-60
Connecting rod nut	7/16-20	65-76
Flywheel	½-13	90-100
Rocker shaft bolt	½-13	90-100
Idler gear hub	½-13	80-90
Blower drive gear	½-20	55-65
Main bearing bolt	5/8-11	180-190
Cylinder head nut	5/8-18	166-176
Crankshaft end bolt	1-14	180-200
Cam and balancer shaft nut	1 1/8-18	300-325
Blower drive gear hub nut	1½-16	50-60
Injector clamp stud	3/8-24	10-25
Water manifold stud	3/8-16	10-25
Exhaust manifold stud	7/16-14	15-30
Cylinder head stud	5/8-11	35-75

m. Adjustment Data.

V-belts	¾in. depression between pulleys
Valves	0.009 in. (cold)

n. Time Standards. Table II lists the number of man-hours required under normal conditions for various operations in the maintenance and repair of the generator set. The man-hours listed are not intended to be rigid standards. Under adverse conditions, the operations will take considerably longer; whereas, under ideal conditions with highly skilled mechanics, most of the operations can be accomplished in considerably less time.

Table II. Time Standards

	Hours
Lubrication and Service	
01 ENGINE	
0100 ENGINE ASSEMBLY	
Engine assembly	1.5
(drain, refill with new oil-drain governor reservoir.)	
0106.2 OIL FILTERS	
Filter assembly	0.8
(replace element, clean and install.)	
0106.3 OIL COOLER	
Core assembly, oil cooler	1.0
(drain, clean element.)	
0106.5 CRANKCASE VENTILATION	
Separator assembly	0.6
(firewall removed.)	
03 FUEL SYSTEM	
0304 AIR CLEANER	
Air cleaner	0.6
(remove, clean, refill with new oil and install.)	
Remove and Replace	
01 ENGINE	
0100 ENGINE ASSEMBLY	
Engine assembly	16.0
(includes removal and installation of hoods, supports, radiator and separating engine from generator.)	
0101 CRANKCASE, BLOCK, CYLINDER HEAD	
Engine block assembly	30.0
(engine out of unit-includes complete disassembly and reassembly of engine.)	
Head	4.0
(includes removal and installation of manifold and fuel filter assembly.)	
Sleeve assembly cylinder	14.0
(engine out of unit.)	
Tube assembly air box	0.5
0102 CRANKSHAFT	
Bearings	6.0
(engine out of unit-includes removal and installation of oil pan.)	
Crankshaft	8.0
(engine out of unit.)	
Hub, vibration damper	1.0
(radiator removed.)	
Seal, plain encased	2.0
(engine out of unit.)	
0103 FLYWHEEL ASSEMBLY	
Flywheel assembly, crankshaft	1.0
(engine out of unit.)	
Housing	2.0
(engine out of unit.)	
0104 PISTONS, CONNECTING RODS	
Piston assembly	2.5
(engine out of unit-oil pan and head removed.)	
Rod assembly, connecting	2.0
(engine out of unit-oil pan and head removed.)	
0105.1 VALVES	
Guides and springs	4.0
(cylinder head removed.)	
Valves and inserts	3.0
(cylinder head removed.)	
0306 TANKS, LINES, FITTINGS	
Tank assembly	0.3
Strainer, fuel	0.5
0308 ENGINE SPEED GOVERNOR	
Filter assembly	0.4
(replace element, clean and install.)	
Reservoir	0.2
(drain oil.)	
0309 FUEL FILTERS	
Filter	0.5
(drain, clean element, replace, check for leaks.)	

Table II. Time Standard Continued

	Hours
Strainer assembly ..... (drain, replace element, check for leaks.)	- 0.4
0311 PRIMING SYSTEM	
Tank, fluid ..... (install fluid can.)	0.1
Reservoir ..... (clean filter.)	0.2
05 COOLING SYSTEM	
0501 RADIATOR	
Radiator assembly ..... (drain, flush, and refill.)	0.5
06 ELECTRICAL SYSTEM (ENGINE AND VEHICULAR)	
0603 STARTER	
Starter, engine electrical ..... (remove, lubricate, and install.)	0.6
0612 BATTERIES	
Batteries, storage ..... (fill to proper water level.)	0.3
22 MISCELLANEOUS BODY, CHASSIS OR HULL AND ACCESSORY ITEMS	
2207 WINTERIZATION EQUIPMENT	
Tank, fuel ..... (fill with gasoline.)	0.2
Pump and filter ..... (fuel control panel removed, clean screen and bowl.)	0.5
41 ELECTRIC GENERATORS	
4100 GENERATOR ASSEMBLY	
Generator, power ..... (wipe clean.)	0.3
0105.2 ROCKER ARMS, TAPPETS	
Cover, rocker arm ..... (air cleaner removed.)	0.3
Rocker arm assembly valve..... (includes adjustment.)	3.0
Rod, push valve..... (includes removal and installation of rocker arm assembly and adjust valve and injector clearance.)	4.5
0105.3 CAMSHAFTS	
Camshaft ..... (engine out of unit-head and cover removed, gears removed.)	2.5
Weight assembly, balance ..... (engine out of unit, covers and gears removed.)	2.0
Bearings, sleeve ..... (camshaft removed.)	1.0
0105.5 TIMING GEARS	
Gears, helical ..... (engine out of unit.)	2.5
0106.1 OIL PUMP	
Pump, oil ..... (engine out of unit.)	2.0
0106.2 OIL FILTERS	
Filter assembly, oil	1.0
0106.3 OIL COOLER	
Core assembly, oil cooler	1.5
Valve, bypass	0.4
0106.5 CRANKCASE VENTILATION	
Pipe assembly, breather	0.3
Separator assembly ..... (firewall removed.)	0.5
0106.6 OIL PAN, LINES, LEVEL GAGE	
Flange	0.2
Tube assembly	0.6
Oil pan ..... (engine out of unit.)	1.0
Cap	0.2
0108 MANIFOLDS	
Manifold	1.5
0109.1 ACCESSORY DRIVE	
Coupling, blower drive ..... (blower removed.)	0.6
03 FUEL SYSTEM	
0301 FUEL INJECTOR	
Injector assembly, fuel..... (includes removal and installation of cover, rocker arm assembly and timing.)	2.0
0302.1 FUEL TRANSFER PUMP	
Pump assembly, fuel	1.0
0302.2 DIESEL INJECTOR PUMP	
Pump assembly, fuel	0.5
0304 AIR CLEANER	
Air cleaner.....	0.3
0305 SUPERCHARGER, BLOWER OR TURBOCHARGER	
Blower assembly ..... (includes removal and installation of air cleaners, water pump and fuel pump.)	2.0
Coupling half, shaft	0.5
0306 TANKS, LINES, FITTINGS	
Strainer, fuel	0.5
Line assembly	1.0
Tank assembly ..... (includes removing skid base end.)	2.5
Reservoir	1.0
0308 ENGINE SPEED GOVERNOR	
Governor assembly.....	1.0
Magnetic assembly	1.0
Filter assembly ..... (replace element, clean and install.)	0.8
Reservoir ..... (drain oil.)	0.5
0308.2 GOVERNOR DRIVE	
Drive assembly, governor ..... (governor removed.)	0.5
0309 FUEL FILTERS	
Filter assembly.....	0.6
Strainer assembly	0.8
0311 PRIMING SYSTEM	
Pump, air	1.0
Reservoir ..... (clean filter.)	0.5
Tank, fluid	0.5
Nozzle, priming	0.3
0312 ACCELERATOR, THROTTLE OR CHOKE CONTROLS	
Tube assembly, injector ..... (valve cover removed.) (includes adjustment.)	0.7
Lever, injector, control ..... (valve cover removed.)	0.3

Table II. Time Standards-Continued

	Hour*
04 EXHAUST SYSTEM	
0401 MUFFLER AND PIPES	
Pipe and rain cap (hood removed.)	0.2
06 COOLING SYSTEM	
0501 RADIATOR	
Radiator assembly	2.0
Shutter (radiator removed.)	1.0
Valve assembly	0.2
0603 LINES AND FITTINGS, HOSES, PIPE, CLAMPS	
Hoses, rubber	0.5
Clamps, hose	0.2
Cock, drain	0.1
0604 WATER PUMP	
Pump (governor oil filter removed.)	1.0
0606 FAN ASSEMBLY	
Fan, engine cooling	0.8
Guard, fan	0.3
Belts, V (includes adjustment.)	0.6
Hub and bracket	0.8
0506 WATER MANIFOLDS, HEADERS, THERMOSTATS AND HOUSING, GASKETS	
Tube assembly	0.5
Manifold, water (muffler removed.)	0.5
06 ELECTRICAL SYSTEM (ENGINE AND VEHICULAR)	
0601 GENERATOR	
Generator, engine accessory	0.5
Belt, generator (includes adjustment.)	0.7
Brackets (generator removed.)	0.5
Cable assembly	0.3
0602 GENERATOR REGULATOR	
Regulator, voltage (includes adjustment.)	0.9
Rectifier	0.5
0603 STARTER	
Starter, engine electrical	1.0
Relay, solenoid, engine starter, electrical (starter removed.)	0.5
0606 ENGINE CONTROLS	
Governor, overspeed	1.5
Switches (ea)	0.5
Solenoid, electrical	0.8
Relay assembly	0.5
0607 INSTRUMENT OR ENGINE CONTROL PANEL	
Meters (ea)	0.4
Switches (ea)	0.3
0608 MISCELLANEOUS ITEMS	
Receptacle, electrical	0.5
Receptacle	0.5
Harness Assembly	8.0
0612 BATTERIES	
Batteries, storage	0.8
Cable assembly (e)	0.5
15 FRAME	
1501 FRAME ASSEMBLY	
Stud, ground	0.1
Base assembly (includes removal and installation of housing engine, and generator.)	-20.0
17 BODY; CAB; HOOD; HULL	
1708 STOWAGE RACKS, BOXES, STRAPS	
Cover assembly tool box	0.3
22 MISCELLANEOUS BODY, CHASSIS OR HULL AND ACCESSORY ITEMS	
2201 CANVAS ITEMS	
Cover, canvas	0.2
2207 WINTERIZATION EQUIPMENT	
Heater assembly (radiator support removed.)	1.0
Receptacle outside source	0.3
Switches (ea)	0.2
Fuse	0.1
Holder, fuse	0.2
Valves, shutoff	0.5
Tank, fuel (radiator support removed.)	0.5
Pump, fuel (fuel panel removed.)	0.5
Filter, fuel (fuel panel removed.)	0.3
Hose: (fuel panel removed.)	0.4
Lines, eater	1.5
Element, battery	0.5
Thermostat, water	0.5
Element, battery	1.0
Thermostats	0.8
Valve, safety	0.2
Transformer	0.3
Relay	0.3
Harness, wiring	2.5
Panel, control	0.5
2210 DATA PLATES AND INSTRUCTION HOLDERS	
Plates, data	0.3
Plates, instruction	0.5
41 ELECTRIC GENERATORS	
4100 GENERATOR ASSEMBLY	
Generator assembly (includes removal and installation of hood, control cabinet, wiring harness.)	12.0
4100.1 ROTOR ASSEMBLIES	
Rotor (generator out of unit.)	2.0
4100.2 STATOR ASSEMBLIES	
Stator (generator out of unit.)	8.0
4100.8 BRUSH HOLDERS	
Brush, electrical (all) (with access door & screens removed.)	0.5
Holder, brush (includes adjustment.)	0.8
4100.4 VENTILATING SYSTEM	
Screens	1.0

Table II. Time Standards-Continued

	Hours
4100.5 FRAME SUPPORTS AND HOUSINGS	
End frame (generator removed.)	2.0
Bearing (end frame removed.)	1.0
4100.6 DRIVE COMPONENTS	
Fan and fan drive (generator removed.)	0.5
4100.7 CONTROL PANELS, HOUSINGS, CUBICLES	
Meters, frequency and kilowatt	1.0
Lamp	0.1
Harness, wiring	2.0
4100.8 MASTER OR AUXILIARY CONTROL ASSEMBLY	
Computer assembly, governor	0.5
4100.9 CIRCUIT BREAKER ASSEMBLY	
Circuit breaker assembly (control cabinet removed.)	0.8
4100.10 SWITCHES	
Switches (ea)	0.2
4100.12 RESISTORS	
Resistor	0.3
Rheostats (ea)	0.5
4100.14 FUSE AND FUSE HOLDERS	
Holder, fuse	0.4
Fuse	0.1
4100.16 TRANSFORMERS; RECTIFIERS	
Transformers	1.0
4100.17 TERMINAL BLOCKS, JUNCTION BOXES	
Receptacle, 126V (ea)	0.3
Receptacle, power	1.0
Terminal board	2.0
Change, block	0.4
4100.18 HOUSING OR HULL PANELS AND ATTACHING PARTS	
Doors and hood	1.5
Supports and panels	2.0
Guard, radiator	0.5
4100.19 RADIO INTERFERENCE SUPPRESSION	
Capacitors	0.5
Leads, electrical	0.3
47 GAGES (NON-ELECTRICAL); WEIGHING AND MEASURING DEVICES	
4703.1 OIL PRESSURE GAGES	
Gage, oil pressure	0.2
Line, oil	0.5
4706 FUEL GAGES (QUANTITY)	
Gage, fuel	0.3
4708 TEMPERATURE GAGES	
Thermometer, temperature	0.6
76 FIRE FIGHTING EQUIPMENT	
7603 FIRE EXTINGUISHERS	
Extinguisher, fire	0.1

CHAPTER 2

GENERAL MAINTENANCE INSTRUCTIONS

Section I. SPECIAL TOOLS AND EQUIPMENT

5. Special Tools and Equipment

The special tools and equipment required to perform the repair and overhaul operations on the engine, generator, and their accessories are listed in Table III and in TM 5-6115-293-35P. References and illustrations indicating the use of these tools are listed in the table. The five-digit code preceding the stock number is the Federal Supply Code Number for the manufacturer of the tools or tool.

Table III. Special Tools and Equipment

Item	FSN or Part No.	Reference		Use
		Fig.	Par.	
Remover, valve spring and injector.	(75282) J-1227-A	35	73	Valve spring removal and installation. Fuel injector removal.
Injector timing gage.	(72582) J-1853	37	73	To time injectors.

6. Specially Designed Tools

No specially designed tools are required to perform field and depot maintenance on the generator set.

7. Wiring Harnesses and Wire Leads

The electrical circuits in the generator set are completed by individual wire leads or by leads laced or enclosed in a loom to form a wiring harness. Replace worn, frayed, or damaged wire leads or wiring harnesses. Follow the diagram as shown in figure 1 and tag for proper identification all leads that are to be removed or replaced. Remove leads from terminal by removing screws, nuts, lock washers, and clamps and by unsoldering soldered connections. Replace individual leads in the wiring harnesses by disconnecting the faulty leads and by taping replacement leads alongside the harness. Tape any uninsulated faulty wire as far as practical. Connect the replacement leads and make certain the connections are clean and secure. Thoroughly insulate the leads where applicable.

(Foldin, in back of manual)

Section II. TROUBLESHOOTING

8. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the generator set or any of its components. Each trouble symptom stated is followed by a list of probable causes of trouble. The possible remedy recommended is described opposite the probable cause.

9. Engine Hard to Start or Fails to Start

Probable cause	*Possible remedy*
Exhaust valves leaking	Repair or replace exhaust valves (par. 77).
Pistons or sleeves worn or scored.	Replace pistons (par. 104) or liners (par. 108).
Injector improperly timed	Adjust injector timing (par. 73).
Injectors dirty or leaky	Clean or replace injectors (par. 73).
Blower defective	Repair or replace blower (par. 64).

10. Engine Misses or Runs Erratically

Probable cause	*Possible remedy*
Compression low	Test compression (par. 77).
Injectors timed improperly	Time injectors (par. 73).
Governor linkage binds or is defective.	Free or replace the governor linkage (par. 81).

Probable cause	*Possible remedy*
Exhaust valves burned	Reseat or replace the exhaust valves (par. 77).
Injectors dirty or leaky	Repair or replace injectors (par. 73).

11. Engine Stops Suddenly

Probable cause	*Possible remedy*
Oil pressure low	Repair or replace the oil pump (par. 86).
Fuel pressure low	Repair or replace the fuel injector pump (par. 67).
Engine temperature high	Repair or replace the radiator (par. 48).
Overspeed governor defective.	Repair or replace the overspeed governor (par. 79).

12. Engine Overheats

Probable cause	*Possible remedy*
Water pump defective	Repair or replace the water pump (par. 61).
Radiator defective	Repair or replace the radiator (par. 48).
Coolant passages in cylinder block clogged.	Clean the cylinder block (par. 108).
Lubricating oil gallery in cylinder block plugged.	Clean the oil gallery in cylinder block (par. 108).
Cylinder block cracked	Replace the cylinder block (par. 108).

13. Engine Smokes Excessively

Probable cause	*Possible remedy*
Fuel injector timing improper	Time the fuel injectors (par. 73).
Fuel injectors faulty	Repair or replace fuel injectors (par. 73).
Piston rings worn or broken	Replace the piston rings (par. 104).
Exhaust valve not seating properly.	Replace the exhaust valves or seats (par. 77).

14. Engine Oil Pressure Low

Probable cause	*Possible remedy*
Connecting rod bearings, crankshaft, or main bearings worn.	Replace connecting rod bearings (par. 104). Replace crankshaft or main bearings (par. 106).
Oil pump relief valve sticking.	Clean or replace the oil pump relief valve (par. 86).
Oil pump screen clogged	Clean the oil pump screen (par. 86).
Oil pump defective	Repair or replace the oil pump (par. 86).
Lubricating oil diluted with fuel oil.	Repair or replace the injector (par. 73).

15. Engine Lacks Power

Probable cause	*Possible remedy*
Fuel injector timing improper.	Time the fuel injectors (par. 73).
Fuel injectors faulty	Repair or replace the fuel injectors (par. 73).

16. Engine Noisy

Probable cause	*Possible remedy*
Piston, piston pins, or rings defective.	Replace piston, piston pins, or rings (par. 104).
Connecting rods or main bearings defective.	Replace connecting rod (par. 104) or main bearings (par. 106).
Fuel injector defective	Repair or replace fuel injector (par. 73).
Blower defective	Repair or replace blower (par. 64).
Gear train defective	Replace gear train (par. 98).
Crankshaft defective	Replace crankshaft (par. 106).
Flywheel loose	Tighten the flywheel mounting bolts (par. 95).

17. Starter Fails to Operate

Probable cause	*Possible remedy*
Starter defective	Repair starter (par. 59).

18. Starter Runs but Does Not Turn Engine

Probable cause	*Possible remedy*
Flywheel defective	Replace flywheel (par. 96).
Starter drive defective	Replace starter drive (par. 69).

19. Battery-Charging Generator Fails to Charge

Probable cause	*Possible remedy*
Battery-charging generator defective.	Repair battery-charging generator (par. 52).

20. Main Generator Fails to Build Up Rated AC Voltage

Probable cause	*Possible remedy*
Static exciter defective	Repair or replace static exciter (par. 134).
Voltage regulator defective	Repair or replace the voltage regulator (par. 132).
Main generator defective	Repair or replace the main generator (par. 138).

21. Frequency Meter or Kilowatt Registers Incorrectly

Probable cause	*Possible remedy*
Wiring defective	Repair or replace wiring (par. 7).
Frequency meter or kilowatt meter defective.	Replace frequency meter or kilowatt meter (par. 116 or 117).

22. Main Generator Voltage and Frequency Erratic

Probable cause	*Possible remedy*
Voltage regulator defective	Repair or replace voltage regulator (par. 132).
Governor defective	Repair or replace governor (par. 81).
Static exciter defective	Repair or replace the static exciter (par. 134).

23. Main Generator Voltage Drops Under Load

Probable cause	*Possible remedy*
Voltage regulator defective	Repair or replace voltage regulator (par. 132).
Collector ring defective	Repair or replace collector ring (par. 138).
Brush holder defective	Replace brush holder (par. 138).
Static exciter defective	Repair or replace static exciter (par. 134).

24. Circuit Breaker Continues to Trip

Probable cause	*Possible remedy*
Circuit breaker defective	Replace circuit breaker (par. 126).

25. Main Generator Overheats

Probable cause	*Possible remedy*
Generator support bearing defective.	Replace the generator support bearing (par. 138).
Generator stator defective	Repair or replace the generator stator (par. 138).
Generator rotor defective	Repair or replace generator rotor (par. 138).

26. Main Generator Noisy

Probable cause	*Possible remedy*
Generator support bearing defective.	Replace generator support bearing (par. 138).
Fan defective	Replace fan (par. 138).

27. Main Generator Fails to Maintain Kilowatt Load Division During Parallel Operation

Probable cause	*Possible remedy*
Generator defective	Repair or replace governor (par. 81).
Governor load computer defective.	Repair or replace governor load computer (par. 136).

28. Main Generator Fails to Maintain Reactive Load Division During Parallel Operation

Probable cause	*Possible remedy*
Crosscurrent transformer defective.	Replace crosscurrent transformer (par. 138).
Crosscurrent rheostat defective.	Replace crosscurrent rheostat (par. 119).

29. Coolant Heater Fails to Ignite

Probable cause	*Possible remedy*
Flame switch defective	Replace flame switch (par. 142).
Limit switch defective	Replace limit switch (par. 142).
Electrical wiring defective	Repair or replace defective electrical wiring (par. 7).
Igniter or resistor burned out	Replace igniter or resistor (par. 142).
Thermal relay defective	Replace thermal relay (par. 142).
Fuel nozzle defective	Replace fuel nozzle (par. 142).
Regulator valve defective	Replace regulator valve (par. 142).
Burner wick defective	Replace burner wick (par. 142).

30. Heater Fails to Keep Burning

Probable cause	*Possible remedy*
Flame switch defective	Replace flame switch (par. 142).
Limit switch defective	Replace limit switch (par. 142).
Blower motor defective	Replace blower motor (par. 142).

31. Heater Smokes

Probable cause	*Possible remedy*
Blower motor defective	Replace blower motor (par. 142).
Generator nozzle defective	Replace generator nozzle (par. 142).
Regulator valve defective	Replace regulator valve (par. 142).

Section III. RADIO INTERFERENCE SUPPRESSION

32. General

The general methods used to attain proper radio interference suppression are contained in TM 56115-293-12. For general information on radio interference suppression, refer to TM 11-483.

33. Interference Suppression Components

The engine accessory generator voltage regulator contains two 0.25-uf (microfarad), feed-through capacitors, which are installed in the voltage regulator.

34. Replacement of Interference Suppression Components

Refer to paragraph 56 for replacement of the radio interference suppression components contained in the engine accessory generator voltage regulator.

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

35. General

The generator is bolted to the engine flywheel housing. The generator fan is bolted to the engine flywheel to provide a direct drive for the generator. The generator is attached to the top side rails. The engine is supported by 2 rear supports and 1 upper and 1 lower front engine support.

36. Engine

a. Drain and fill with water and oil (TM56115-293-12).

b. Remove and install the lifting frame (par. 44).

c. Remove and install the batteries and disconnect the battery cable from the engine (TM 5-6115-293-12).

d. Remove and install the fuel lever from the engine (TM 5-6115-293-12).

e. Remove and install the coolant tubes from the engine (pars. 147 and 149).

f. Remove and install the engine as shown in figure 2.

37. Main Generator

a. Remove and install the control cabinet support (par. 41).

b. Remove and install the static exciter (par. 134).

c. Remove and install the main generator as shown in figure 3.

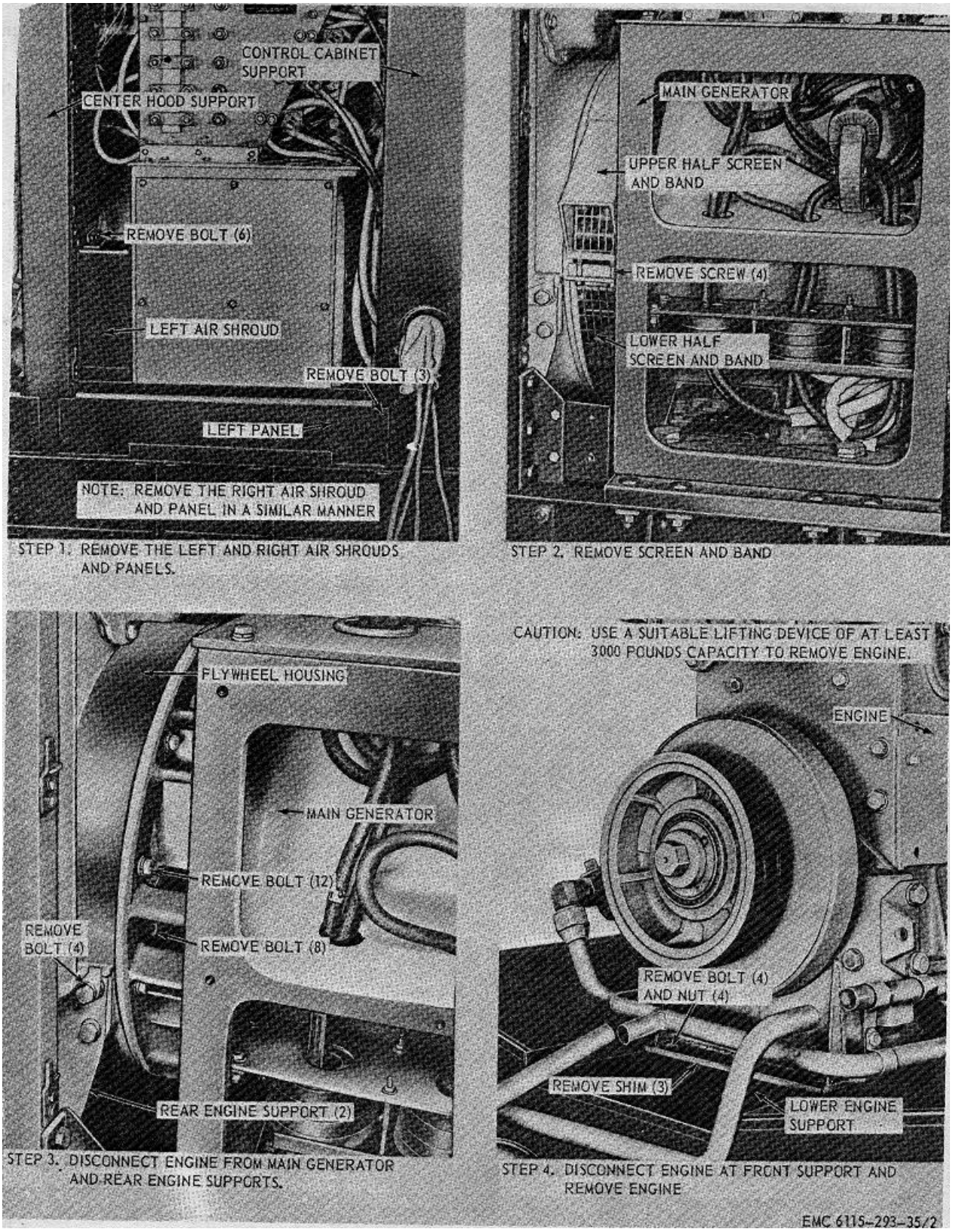


Figure 2. Engine, removal and installation.

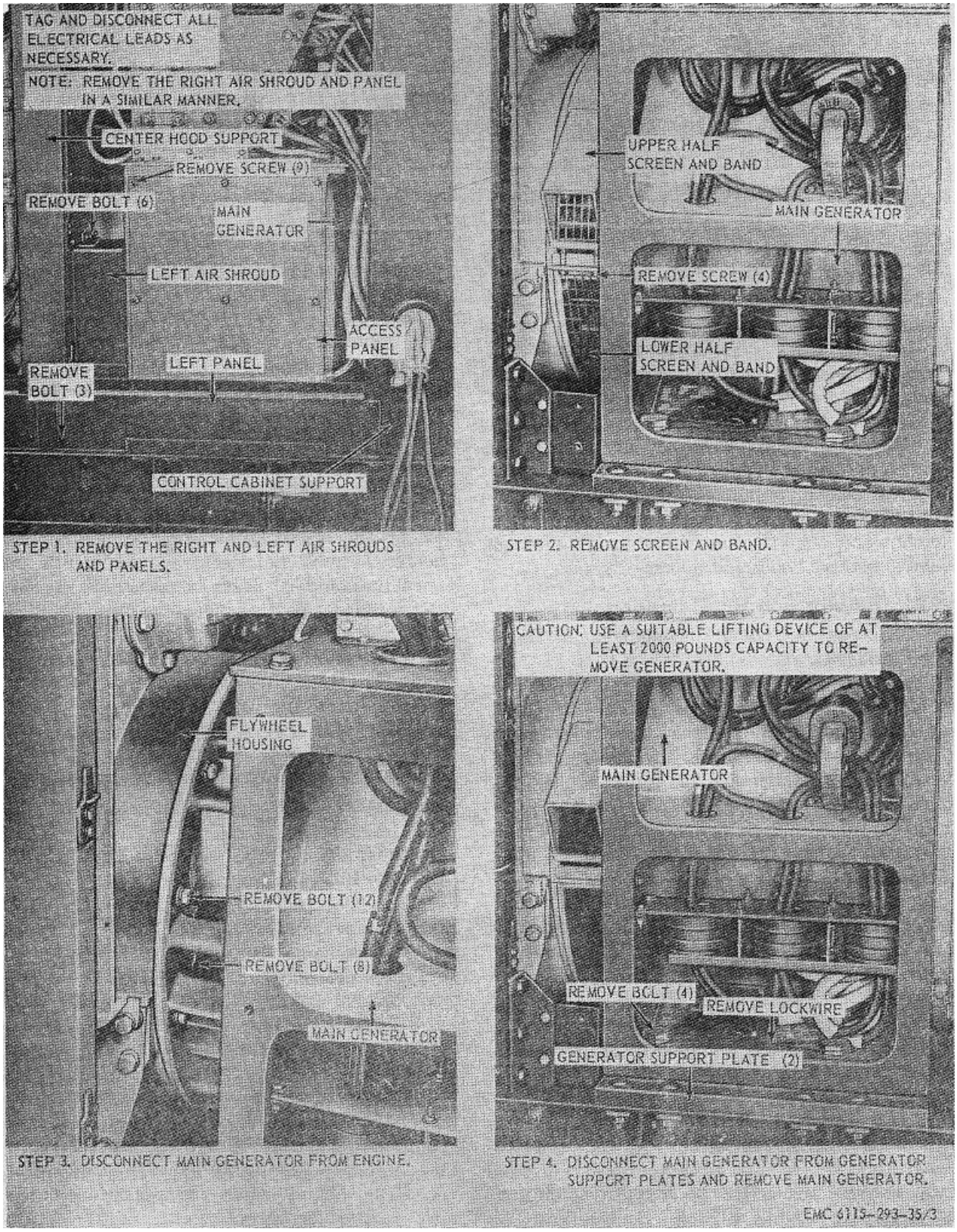


Figure 3. Main generator, removal and installation.

CHAPTER 3

HOUSING, LIFTING FRAME, AND SKID BASE REPAIR INSTRUCTIONS

Section I. HOUSING

38. General

The housing consists of the radiator and hood support, center hood support, and control cabinet support. The radiator and hood support is an aluminum shell which supports the radiator shutter and hood. It is bolted directly to the skid base. The center hood support consists of aluminum channel members bolted together. It is reinforced with the firewall and supports the lifting frame, hoods, and doors. The control cabinet support is an aluminum weldment which is bolted to the skid base. It supports the control cabinet, circuit breaker, load connectors, priming system, and generator hoods and doors.

39. Radiator and Hood Support

a. Remove and install the engine hood (TM 5-6115-293-12).

b. Remove and install the exhaust rain caps (TM 5-6115-293-12).

c. Remove and install the coolant heater fuel pump and tank vent line (TM 5-6115-293-12).

d. Remove and install the radiator hoses and radiator drain hose (TM 5-6115-293-12).

e. Remove and install the fan guards (TM 5-6115-293-12).

f. Remove and install the radiator and hood support as shown by figure 4.

g. Remove and install the radiator as shown by figure 5.

h. Remove and install the shutter as shown by figure 6.

i. Clean and inspect the radiator and hood support.

40. Firewall and Center Hood Support

a. Remove and install the engine and generator hoods (TM 5-6115-293-12).

b. Remove and install the ammeter shunt and starter relay solenoid (TM 5-6115-293-12).

c. Remove and install the governor load computer (par. 136).

d. Remove and install the governor load sensing resistor (par. 140).

e. Remove and install the heater transformer (par. 152).

f. Remove and install the heater relay (par. 151).

g. Tag, disconnect, and reconnect the electrical leads of the water temperature switch, governor operating solenoids, electric governor, fuel shutdown switch, air shutdown solenoid, starters, oil pressure shutdown switch, time delay solenoid, coolant heater assembly, electric coolant heaters, overspeed governor, heater circulating pumps, and heater thermostats. Remove and install the electrical leads and harnesses from the firewall. Refer to figure 1, schematic wiring diagram.

h. Remove, disassemble, reassemble, and install the firewall and center hood support as shown by figure 7.

i. Clean and inspect.

41. Control Cabinet Support

a. Remove and install the generator hood (TM 5-6115-293-12).

b. Remove and install the cable boot (TM 5-6115-293-12).

c. Remove and install the fire extinguisher bracket (TM 5-6115-293-12).

d. Remove and install the radio interference suppression capacitors (TM 5-6115-293-12).

e. Remove and install the brush access panel (TM 5-6115-293-12).

f. Remove and install the ether priming system (TM 5-6115-293-12).

g. Remove and install the coolant heater control box (TM 5-6115-293-12).

h. Remove and install the 115-v (volt) receptacle, fuse, and fuse holder (TM 5-6115-293-12).

i. Remove and install the paralleling receptacle, remote start receptacle, and 24-v receptacle (TM 5-6115-293-12).

j. Remove and install the water temperature

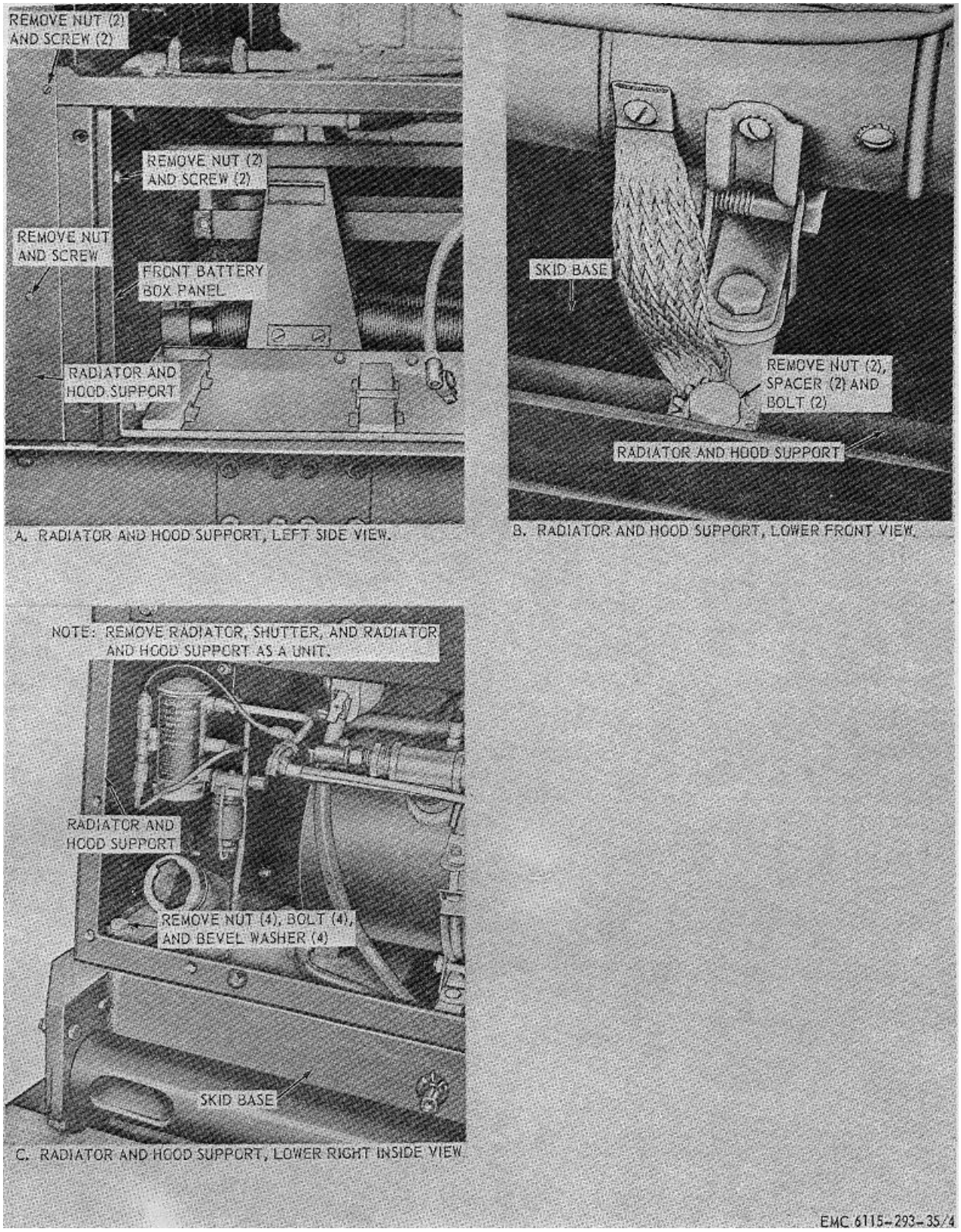


Figure 4. Radiator and hood support, removal and installation.

gage, engine oil gage, time totalizing meter, battery-charging ammeter, engine control switch, and engine start switch (TM 5-6115-293-12).

k. Remove and install the battery box heater switch and coolant heater switch- (TM- 5-6115293-12).

l. Remove and install the circuit breaker (par. 126).

m. Remove and install the control box (par. 124).

n. Remove and install the two load connectors (par. 128).

o. Remove and install the control cabinet support as shown by figure 7.

p. Clean and inspect.

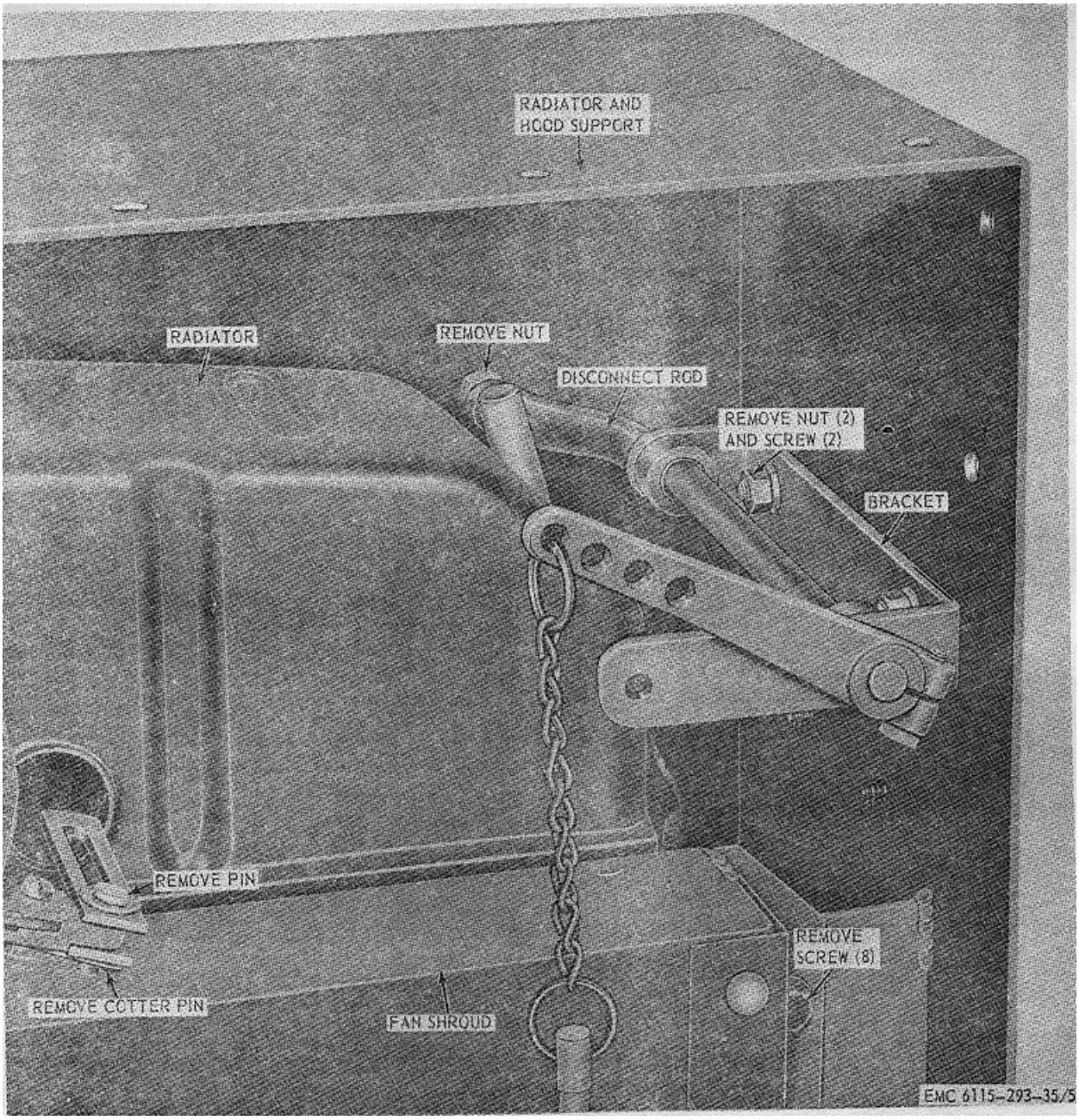


Figure 5. Radiator, removal and installation.

42. Battery Box Panels and Door Stops

a. Remove and install the battery box trays, battery cables, and battery compartment electric heating elements (TM 5-6115-293-12).

b. Remove and install the right- and left-side panels (TM 5-6115-293-12).

c. Remove and install the coolant heater (par. 142).

d, Remove and install the battery box panels and door stops as shown by figure 7.

e. Clean, inspect, and repair.

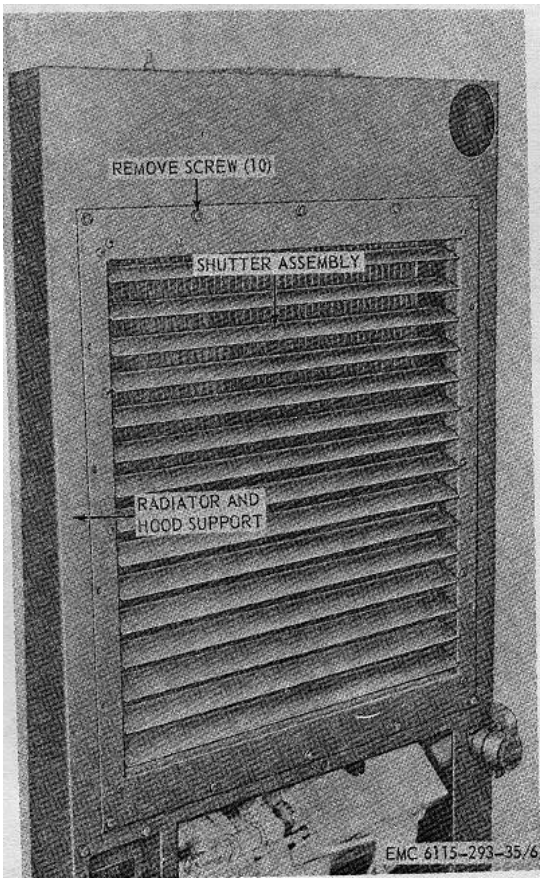


Figure 6. Shutter, removal and installation.

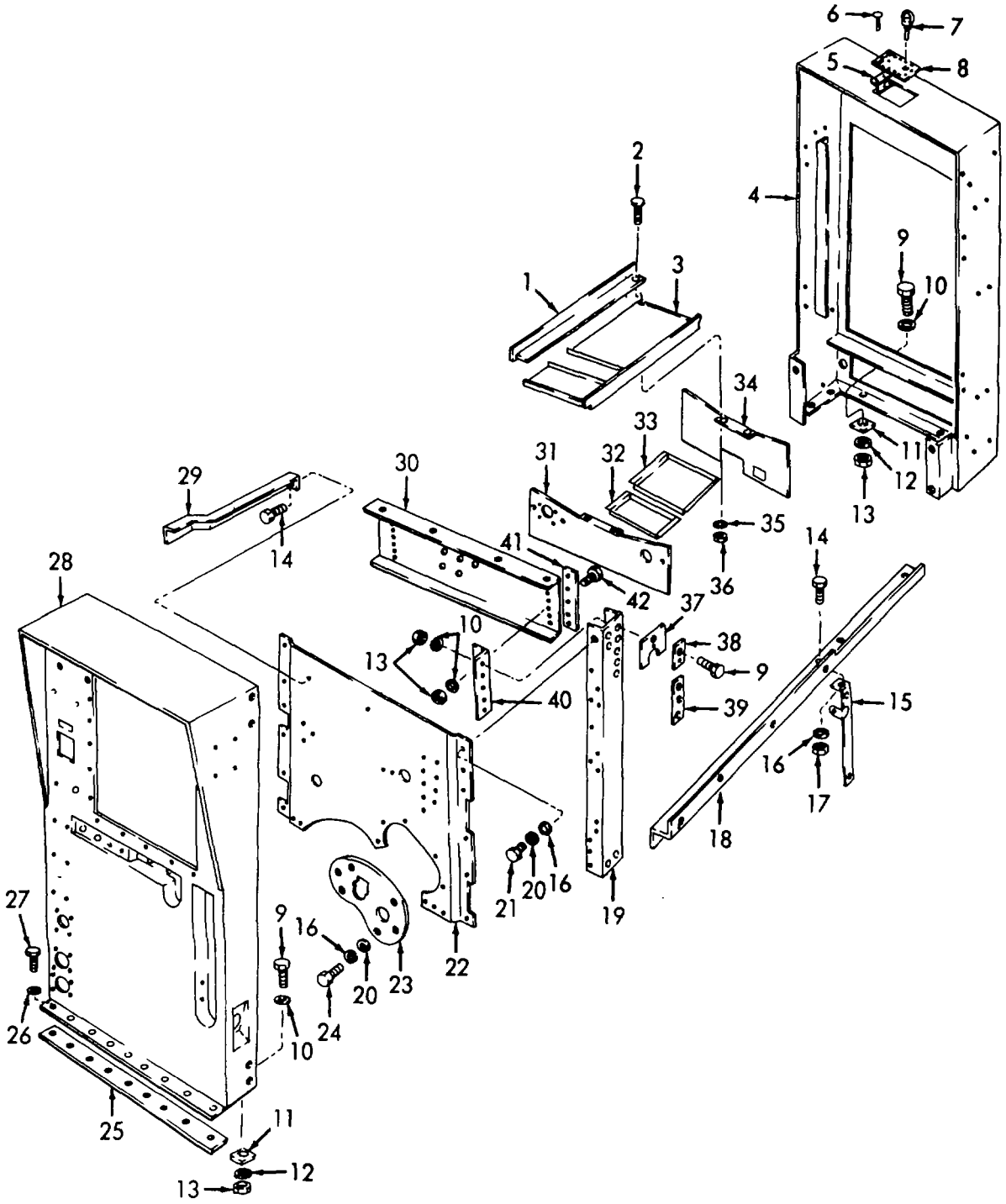


Figure 7. Control cabinet support, firewall, center hood support, battery box, and radiator fill door, removal, disassembly, reassembly, and installation.

1 Battery box shield, lh
2 Screw, cap, Y-20 x 5/ in. (8 rqr)
3 Battery box shield, rh
4 Radiator and hood support
5 Door mounting spacer
6 Rivet, solid, fig x 2 in. (4 rqr)
7 Door fastener
8 Radiator fill door
9 Bolt, machine, hex-hd, Y-13 x 1% in. (18 rqr)
10 Washer, lock, M in. (28 rqr)
11 Bevel washer (spec) (8 rqr)
12 Washer, flat, Y2 in. (8 rqr)
13 Nut, plain, hex, -13 (28 rqr)
14 Screw, cap, hex-hd, s6-18 x Y7 in. (3 rqr)
15 Door support (2 rqr)
16 Washer, lock, 56 in. (20 rqr)
17 Nut, plain, hex, s-18 (2 rqr)
18 Door stop (2 rqr)
19 Center hood support (2 rqr)
20 Washer, flat, 56 in. (18 rqr)
21 Screw, cap, hex-hd, 56-18 x 4 in. (12 rqr)
22 Firewall
23 Firewall plate
24 Screw, cap, hex-hd, 56-18 x X in. (6 rqr)
25 Drip rail
26 Washer, lock, 3 in. (9 rqr)
27 Bolt, machine, hex-hd, s-16 x 1 in. (9 rqr)
28 Control cabinet support
29 Terminal board brace
30 Center hood support
31 Rear panel
32 Rear pan
33 Front pan
34 Front panel
35 Washer, lock, y in. (8 rqr)
36 Nut, plain, hex, Y-20 (8 rqr)
37 Plate (2 rqr)
38 Plate (2 rqr)
39 Plate (2 rqr)
40 Angle (2 rqr)
41 Plate (2 rqr)
42 Bolt, machine, hex-hd, -13 x 11 in. (10 rqr)

Figure 7-Continued

Section II. LIFTING FRAME

43. General

The lifting frame consists of a hinged U-bolt, two aluminum I-beams, angles, and plates. The lifting frame is attached to the front of the engine block and to the center hood support.

44. Lifting Frame

a. Remove and install the firewall (par. 40).

b. Remove and install the lifting frame as shown by figure 9.

c. Disassemble and reassemble the lifting frame as shown by figure 9.

d. Clean, inspect, and repair.

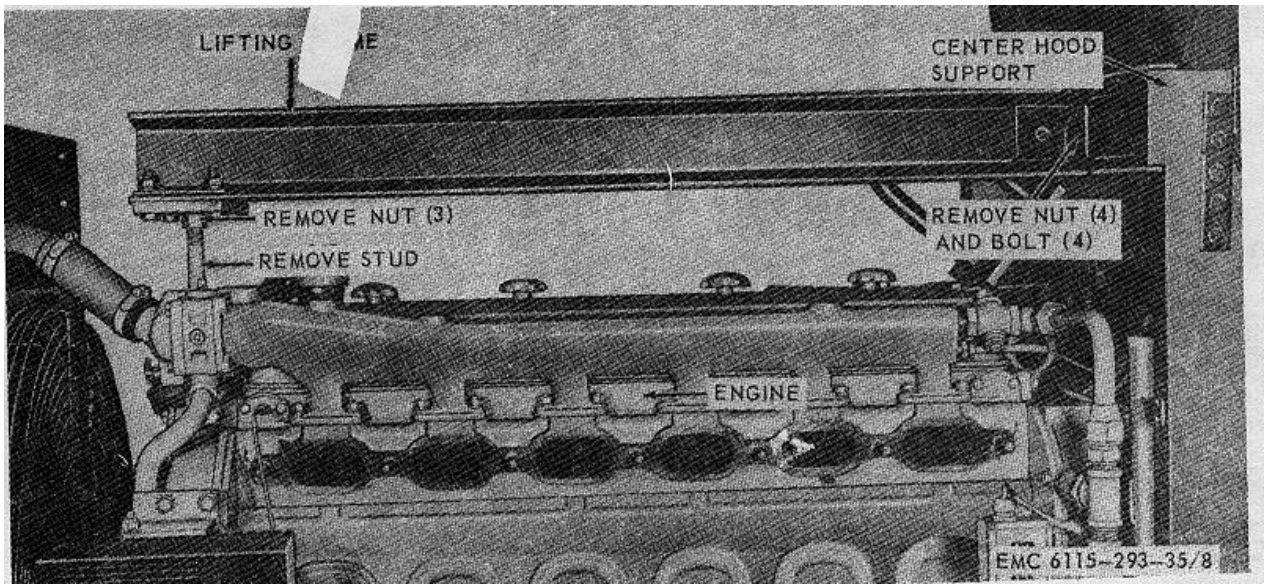
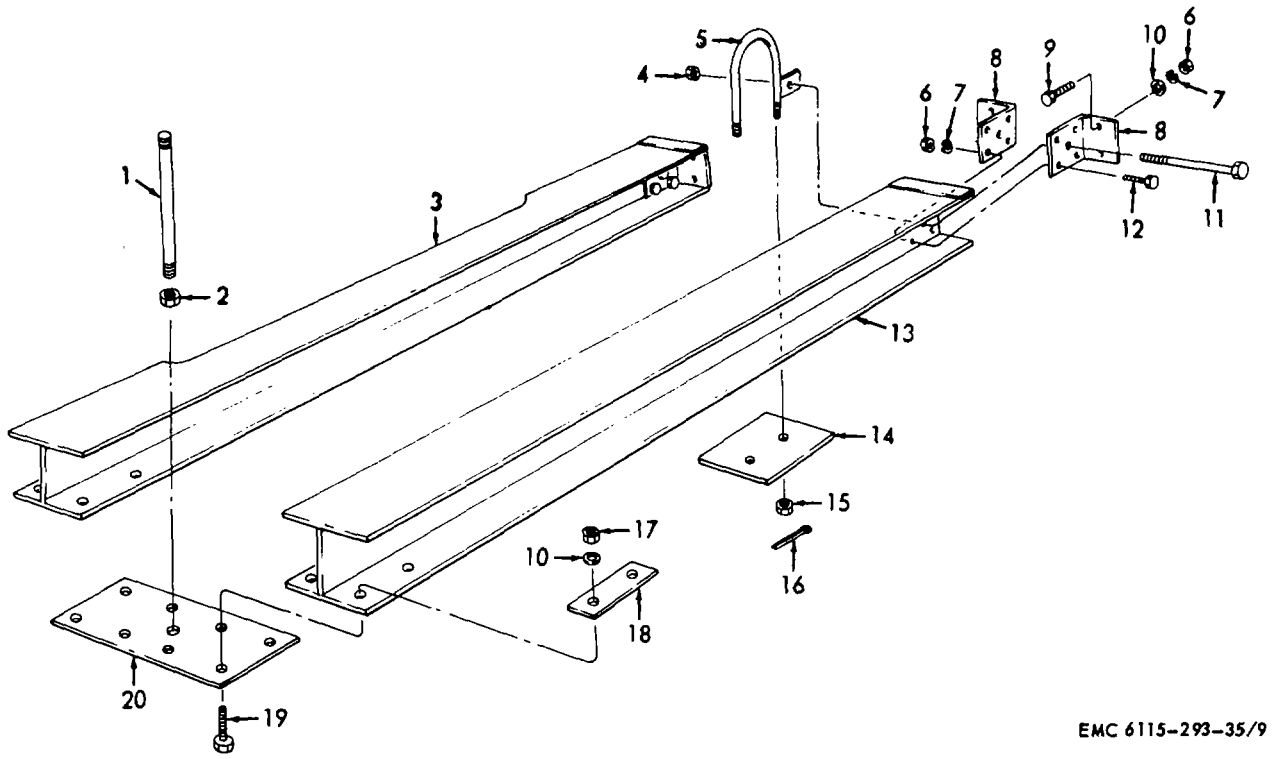


Figure 8. Lifting frame, removal and installation.



1	Beam-to-beam stud (spec)	11	Screw, cap, hex-hd, -20 x 7y in.
2	Nut, plain, hex, S4-10 (2 rqr)	12	Screw, cap, hex-hd, -13 x ' M in. (8 rqr)
3	Left-hand beam	13	Right-hand beam
4	Nut, plain, hex, A-20	14	Plate
5	U-bolt	15	Nut (spec) (2 rqr)
6	Nut, plain, hex, +-13 (8 rqr)	16	Pin, cotter, 3s x 2 in. (2 rqr)
7	Washer, lock, !,i in. (8 rqr)	17	Nut, plain, hex, +20 (8 rqr)
8	Beam-to-firewall angle (4 rqr)	18	Beam spacer (2 rqr)
9	Screw, cap, hex-hd, A-13 x 14 in. (4 rqr)	19	Screw, cap, hex-hd, 2-20 x 2 in. (8 rqr)
10	Washer, flat, % in. (8 rqr)	20	Beam-to-beam plate

Figure 9. Lifting frame, disassembly and reassembly.

Section III. SKID BASE AND SKID BASE END SUPPORT

45. General

The skid base end support braces the rear of the skid base and provides mounting for the control cabinet support. It is also used as a toolbox. The skid base provides a support for the engine, generator, and fuel tank.

46. Skid Base and Skid Base End Support

a. Remove and install the main generator (par. 37).

b. Remove and install the engine lower front support (par. 110).

c. Remove and install the coolant heater fuel tank (par. 143).

d. Remove and install the battery box panels and door stops (par. 42).

e. Remove and install the skid base end support as shown by figure 10.

f. Remove and install the fuel tank (par. 112).

g. Disassemble and reassemble the skid base as shown by figure 11.

h. Clean, inspect, and repair.

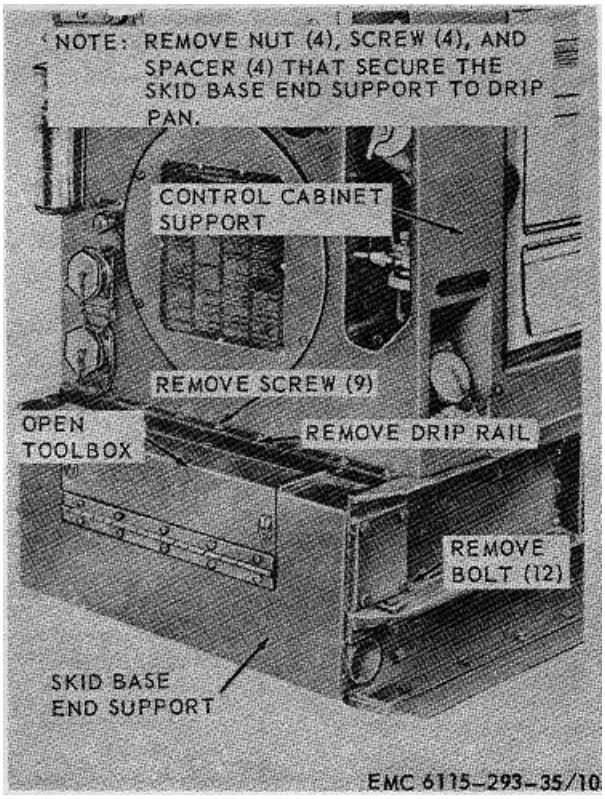
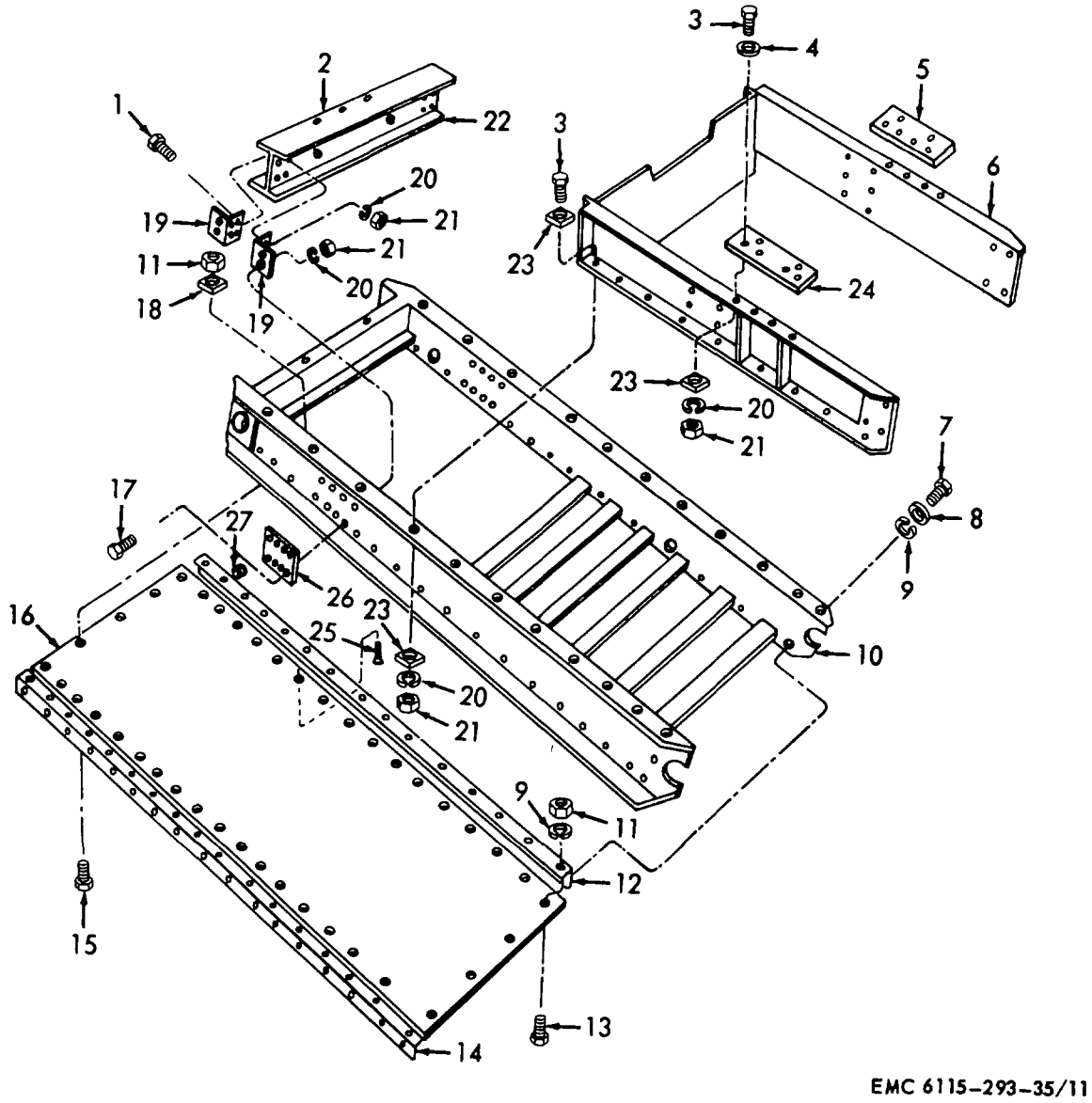


Figure 10. Skid base end support, removal and installation.



1	Screw, cap, hex-hd, -13 x 1 X in. (20 rqr)	15	Bolt, machine, 5s-18 x 1 5 in. (6 rqr)
2	Base crossmember (2 rqr)	16	Bottom drip plate
3	Bolt, machine, +13 x 2 in. (22 rqr)	17	Screw, cap, hex-hd, -13 x 1 in. (16 rqr)
4	Washer, flat, ½ in. (4 rqr)	18	Bevel washer (spec) (5 rqr)
6	Generator mounting plate, rh	19	Crossmember angle (4 rqr)
6	Top side rail	20	Washer, lock, M in. (38 rqr)
7	Bolt, machine, 5r18 x 1 in. (34 rqr)	21	Nut, plain, hex, +13 (38 rqr)
8	Washer, flat, i m. (34 rqr)	22	Plug nut (spec) (2 rqr)
9	Washer, lock, 64i in. (69 rqr)	23	Bevel washer (spec) (36 rqr)
10	Bottom side rail	24	Generator mounting plate, Ih
11	Nut, plain, hex, %-18 (35 rqr)	25	Screw, machine, flat-hd, -5-18 x V in. (2 rqr)
12	Bottom plate support angle, Ih	26	Crossmember plate (2 rqr)
13	Bolt, machine, 56-18 x 54 in. (30 rqr)	27	Plug nut (spec) (34 rqr)
14	Bottom plate support angle, rh		

Figure 11. Skid base, disassembly and reassembly.

Section I. RADIATOR AND SHUTTER THERMOSTAT, SHUTTER, AND FAN GROOVE PULLEY AND BRACKET

47. General

The radiator and shutter are mounted in the radiator shell. The shutter is automatically controlled by the shutter thermostat to regulate the temperature of the coolant within a safe operating range. The groove pulley is driven by the fan V-belts. It actuates the fan blades to blow the air through the radiator and out through the shutter when it is open.

48. Radiator and Shutter Thermostat

a. Remove and install the radiator and linkage (par. 39).

b. Disassemble and reassemble the radiator and shutter thermostat shown by figure 12.

c. Clean, inspect, and repair.

d. Test the shutter thermostat as follows:

(1) Submerge the thermostat and thermometer to get a degree reading in a bucket of hot water and heat the water.

(2) The thermostat should begin to open at 160°F (Fahrenheit) and be fully open at 170°F.

(3) When the thermostat is returned to cool air, it should begin closing immediately.

49. Shutter

a. Remove and install the shutter (par. 39).

b. Disassemble and reassemble the shutter and linkage as shown by figure 13.

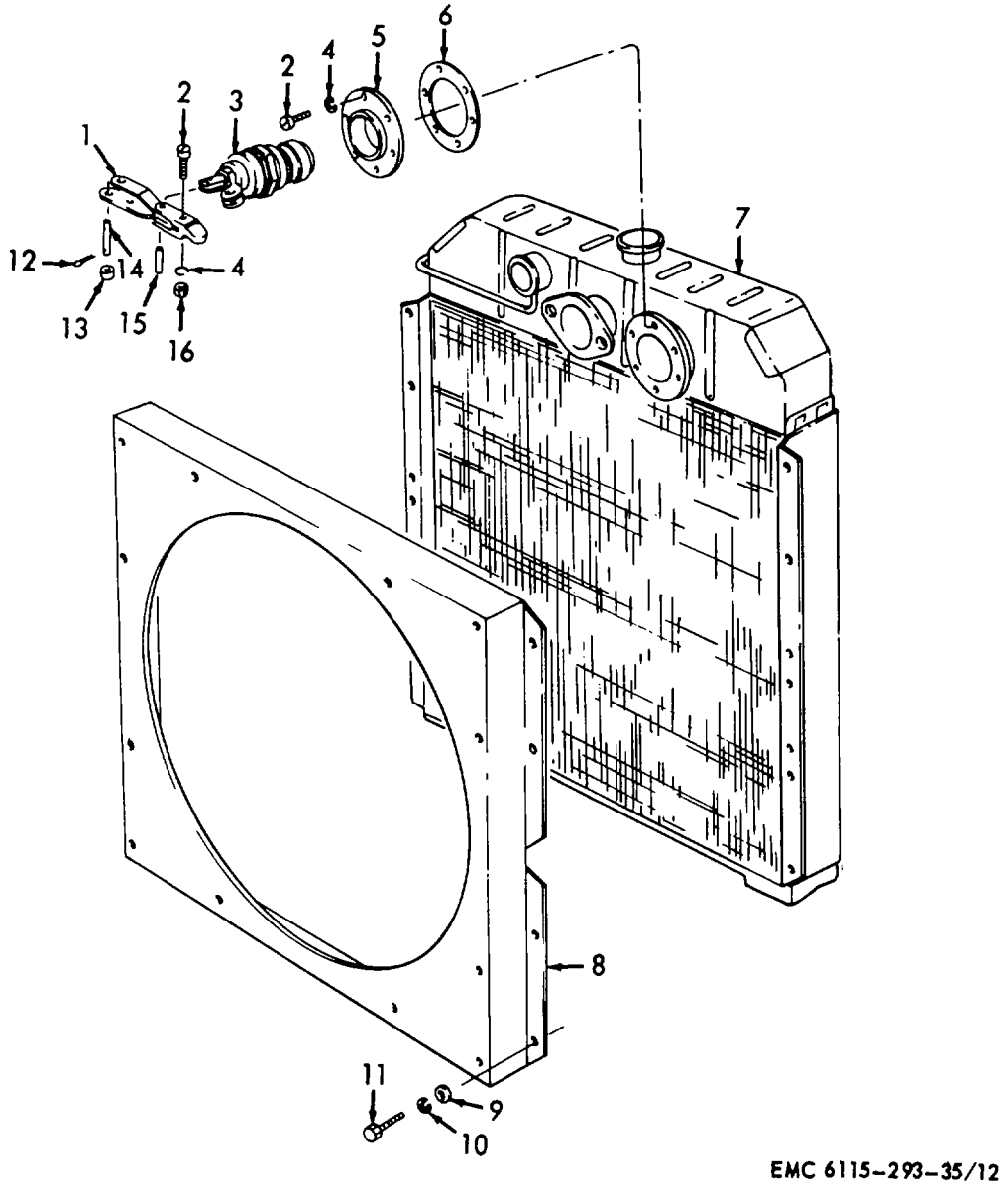
c. Clean, inspect, and repair.

50. Fan Pulley and Hub

a. Remove and install the fan pulley and hub (TM 5-6115-293-12).

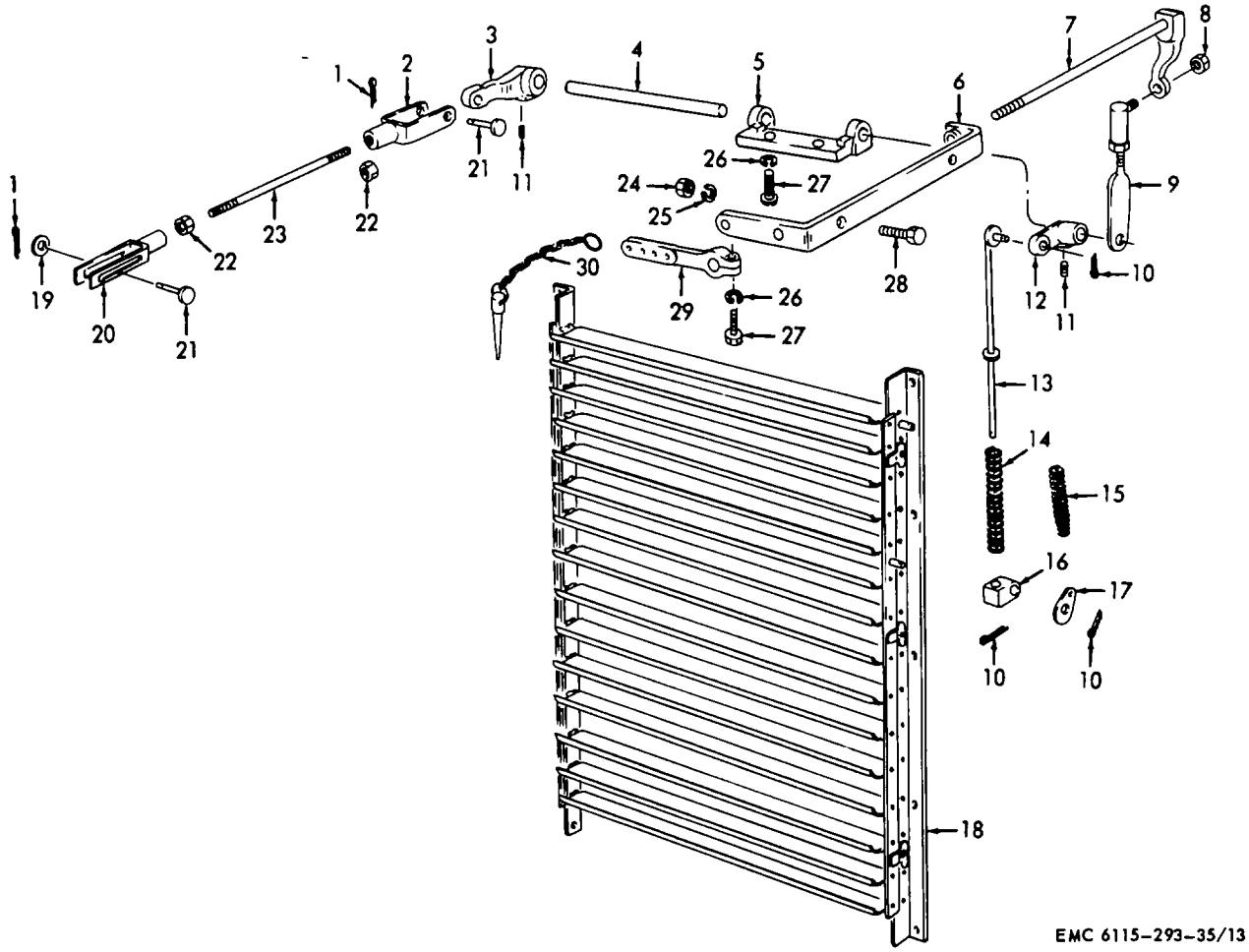
b. Disassemble and reassemble the fan pulley and hub as shown by figure 14.

c. Clean, inspect, and repair.



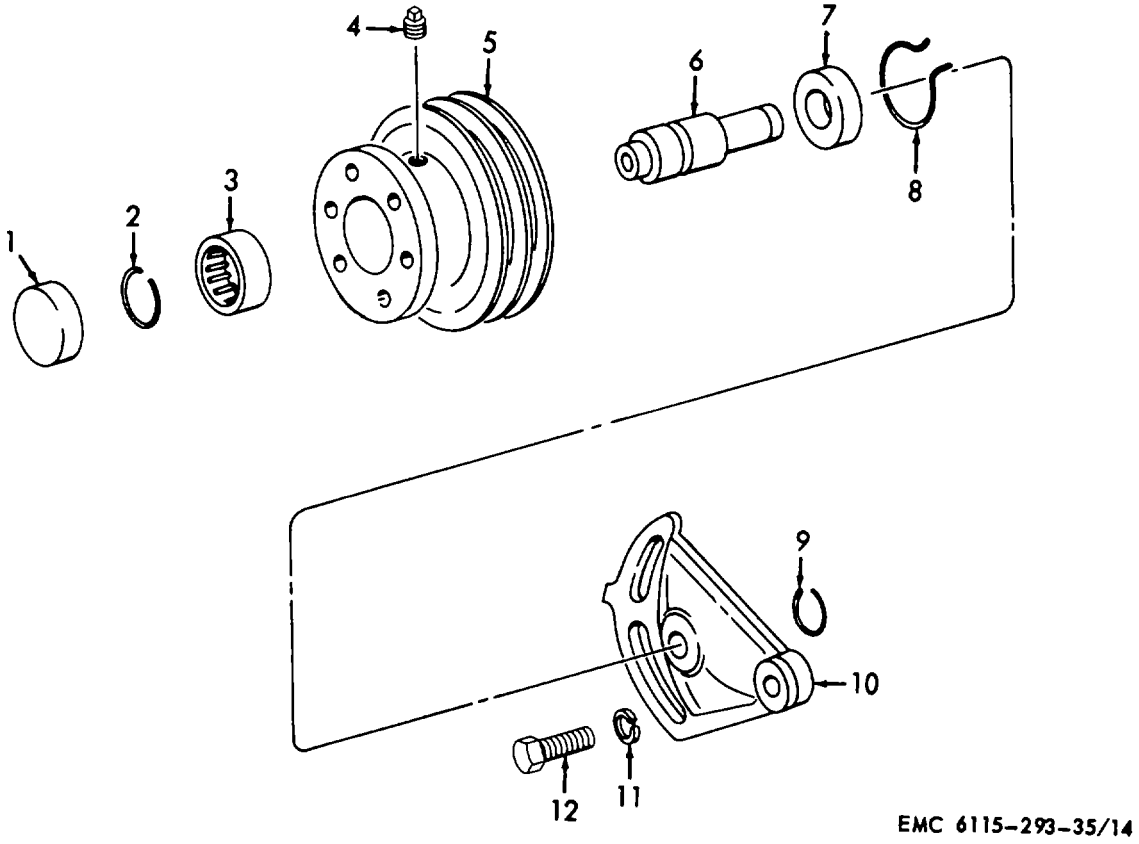
1	Shutter control arm	9	Washer, flat, 5,6 in. (8 rqr)
2	Screw, No. 10-32 x M in. (7 rqr)	10	Washer, lock, J6 in. (8 rqr)
3	Shutter control	11	Bolt, machine, 6-18 x 1 in. (8 rqr)
4	Washer, lock, No. 10 (7 rqr)	12	Pin, cotter, I' x A in. (2 rqr)
5	Shutter control adapter	13	Bushing
6	Gasket	14	Pin, straight, headless, a8 x Ys in.
7	Radiator	15	Pin, straight, headless, 5, x % in.
8	Air shroud	16	Nut, plain, hex, No. 10-32

Figure 12. Radiator, fan shroud, and shutter thermostat, disassembly and reassembly.



1	Pin, cotter, Us x M in. (2 rqr)	16	Swivel block
2	Shutter operating lever yoke	17	Spring retaining clip
3	Shutter operating lever	18	Shutter
4	Shaft	19	Washer, flat, Y in.
5	Lever bracket	20	Shutter operating lever yoke
6	Manual control bracket	21	Pin, straight, headed, Y x 51/64 in. (2 rqr)
7	Lever and shaft	22	Nut, plain, hex, Y-28 (2. '
8	Nut, plain, hex, s5-24	23	Shutter operating lever rc
9	Joint	24	Nut, plain, hex, 5-18 (2 X
10	Pin, cotter, 's x 1 in. (3 rqr)	25	Washer, lock, s6 in. (2 rqr,
11	Setscrew, Y-20 x 56 in. (4 rqr)	26	Washer, lock, Y in. (2 rqr)
12	Lever	27	Screw, cap, hex-hd, Y4-20 x L1 .2 rqr)
13	Shutter closing rod	28	Bolt, machine, 6-i18 x 4 in. (2 r,,..
14	Rod spring	29	Lever
15	Shutter closing spring	30	Chain (spec)

Figure 13. Shutter and linkage, disassembly and reassembly.



1	Cap	7	Ball bearing
2	Retaining ring	8	Retaining ring
3	Roller bearing	9	Retaining ring
4	Plug, pipe, Y27	10	Bracket
5	Pulley	11	Washer, lock, 5A in.
6	Shaft	12	Screw, cap, hex-hd, 5/8 x 1 5/8 in.

Figure 14. Fan pulley and hub, disassembly and reassembly.

Section II. BATTERY-CHARGING GENERATOR

51. General

The battery-charging generator is a 28-volt, 3-phase unit of the alternator type. It is of the rotating field type so that only two sliprings are needed and the sliprings and brushes are required to carry only low-voltage current for exciting the field. Current for exciting the field is supplied, during normal operation, by a portion of the generator output. However, during starting and until generator output has built up sufficiently, the current needed to excite the field is supplied by the batteries.

52. Battery-Charging Generator

a. Remove and install the battery-charging generator (TM 5-6115-293-12).

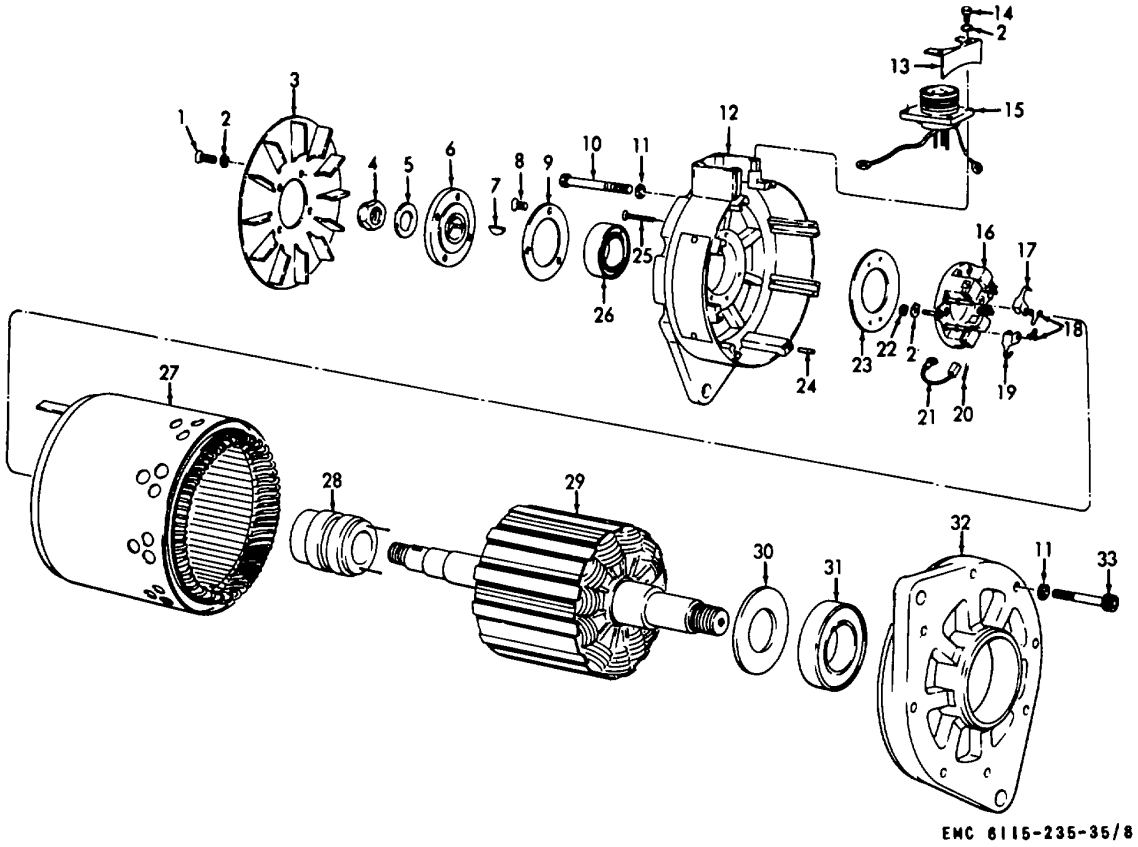
b. Disassemble and reassemble the battery-charging generator as shown by figure 15.

c. Test the rotor on a growler for shorts, opens, and grounds as instructed in TM 6-764. Replace a defective rotor. Test the stator coils with a multimeter for continuity and grounds as instructed in TM 5-764. Replace a defective stator. Use a multimeter and test for continuity between the insulated brush holder and the end housing.

If continuity is indicated, the brush holder or brush holder insulation is defective and must be replaced.

d. Clean, inspect, and repair.

e. After reassembly, bench-test the generator (par. 53).



1	Screw, machine, No. 8-2 x ¼ in. (4 rqr)	18	Helical torsion spring (4 rqr)
2	Washer, lock, No. 8 (10 rqr)	19	Right brush arm (2 rqr)
8	Fan	20	Pin, cotter, 1' x M in. (4 rqr)
4	Nut, self-locking, hex, -20	21	Electrical contact brush (4 rqr)
5	Washer, flat, 3 in.	22	Nut, plain, hex, No. 8-32 (2 rqr)
6	Fan hub	23	Ball bearing retainer
7	Key, woodruff, No. 304	24	Pin, straight, headless, % x IS in.
8	Screw, machine, No. 8-32 x M in. (3 rqr)	25	Screw, machine, No. 8-32 x 34 in. (4 rqr)
9	Ball bearing retainer	26	Annular ball bearing
10	Screw, cap, hex-socket, No. 10-32 x 2¼ in. (7 rqr)	27	Engine generator stator
11	Washer, lock, No. 10 (14 rqr)	28	Slipring assembly
[2	Slipring end housing	29	Generator rotor
18	Terminal cover	30	Baffle washer
1[4	Screw, machine, No. 8-32 x 1 in. (2 rqr)	31	Annular ball bearing
56	Electrical receptacle	32	Drive end housing
16	Electrical contact brush holder	33	Screw, cap, hex-socket, No. 10-32 x 13 in. (7 rqr)
17	Left brush arm (2 rqr)		

Figure 15. Battery-charging generator, disassembly and reassembly.

53. Testing Battery-Charging Generator After Reassembly

a. Test Setup. Place the battery-charging generator in a test stand which incorporates a 7-horsepower driving motor and connect as shown by figure 16. The 0- to 20-ampere ammeter measures the field current of the generator, the 0- to 150ampere ammeter measures the load current, and the-0- to 50-volt voltmeter measures the generator regulator output voltage. The 1-ampere load relay switch must be closed during the test. The closing of the switch closes the load relay in the generator regulator and connects the generator to the 24-volt battery. The load on the generator is varied by means of an electrical load bank, the load bank being connected into the circuit by closing the 150-ampere load switch.

Warning: **When a malfunction of the selenium rectifier occurs, thoroughly ventilate the area to prevent inhalation of poisonous fumes. Do not**

handle the damaged selenium rectifier without gloves. Selenium oxide may be absorbed through the skin, especially when the selenium rectifier is hot. Failure to observe this warning can result in severe illness or death.

b. Performance Test. Operate the generator for 1 hour at a minimum speed of 2,000 rpm under full load of 100 amperes. Then reduce the generator speed to 1,650 rpm. The generator should produce direct current voltage of 28 volts, with an output of 90 amperes and a field current of 7.9 to 12 amperes.

c. Low-speed Test. Immediately following the heat run test, as described in b above, operate the generator at 1,000 rpm. Minimum output must be 55 amperes at 28 volts of direct current.

d. Insulation Test. Using a megometer, measure the insulation resistance between the end housing of the generator and each receptacle pin in turn for not less than 1 minute. Resistance should not measure less than 0.1 megohm.

e. Overspeed Test. Disconnect the generator from the electrical circuit and operate it at 8,000 rpm for 5 minutes. Listen for any unusual noises that might indicate mechanical failure.

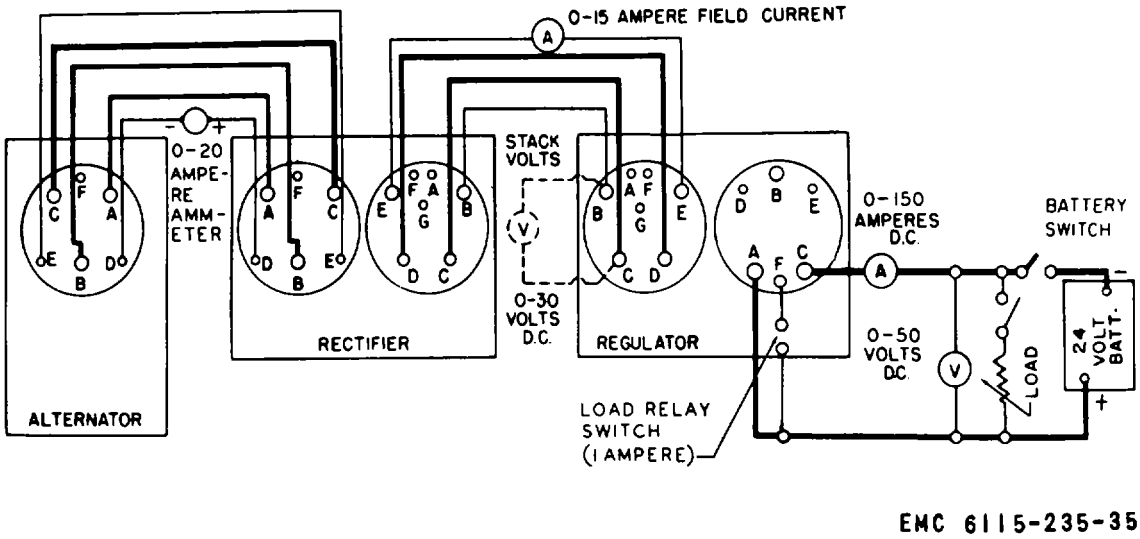


Figure 16. Battery-charging generator, rectifier, and generator regulator, test block wiring anagram.

Section III. GENERATOR REGULATOR

54. General

The generator regulator regulates the current flow and controls the voltage from the batterycharging generator through the metallic rectifier to the batteries. It consists primarily of a carbon pile variable resistance element, a 5-ohm variable resistor, a main relay, and a capacitor. The schematic drawing for the voltage regulator appears in figure 1. The wire connection diagram for the generator regulator is shown in figure 17.

55. On-Engine Voltage Adjustment

a. No-load Test. With fully charged batteries installed in the generator set and with the engine not running, check the battery voltage with a voltmeter. The voltmeter should read 24 volts.

b. Load Test. With the voltmeter connected to the batteries, start the engine and permit the engine to operate at slightly above idle speed. If the voltage is higher than 28 volts, the system is working properly, but the voltage regulation must be adjusted.

c. Adjusting Voltage. Remove the pipe plug from the side of the generator regulator and turn the slotted shaft of the 5-ohm adjustable resistor (par. 56). Turn rheostat clockwise to increase and counterclockwise to decrease the voltage. Make these adjustments slowly while watching the voltmeter and adjust the voltage to 28 volts. If the generator regulator cannot be adjusted to 28 volts, perform the tests given in paragraph 57.

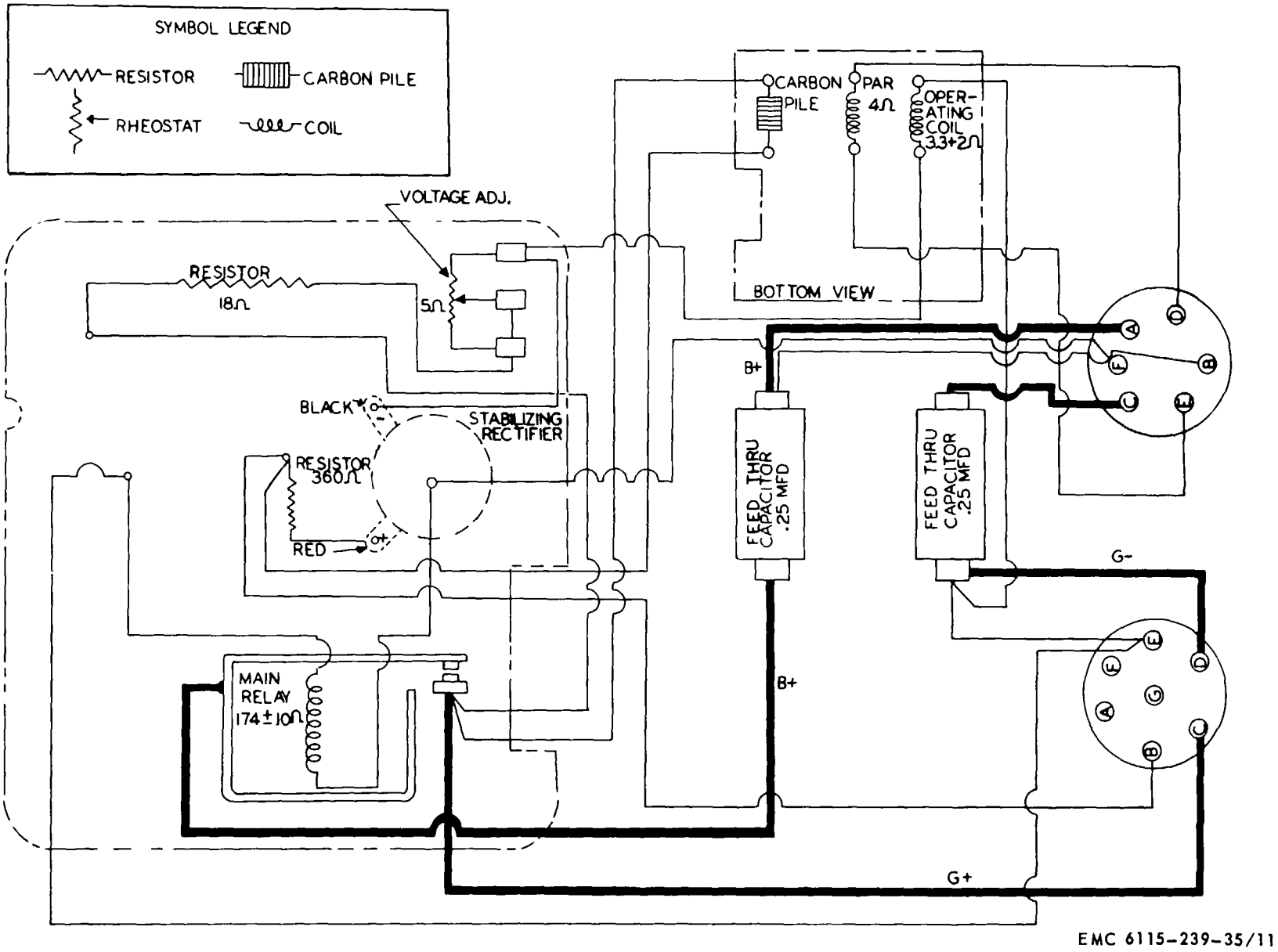


Figure 17. Generator regulator internal wiring diagram.

56. Generator Regulator

a. Remove and install the generator regulator (TM 5-6115-293-12).

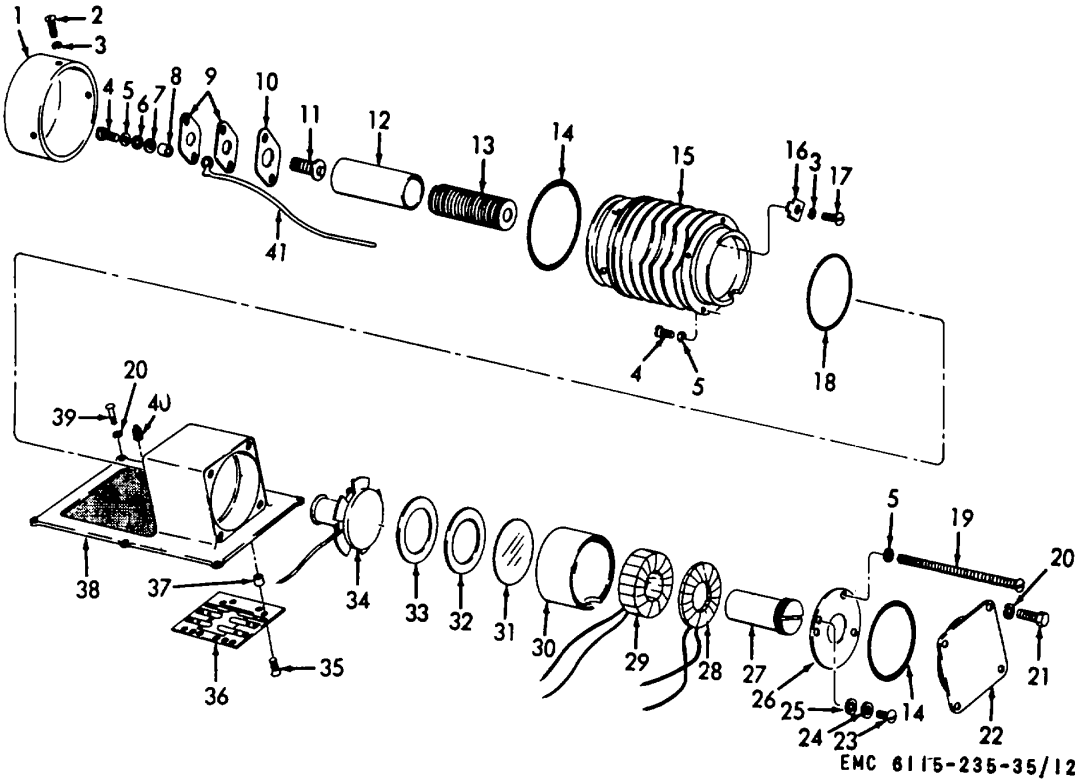
b. Disassemble and reassemble the generator regulator as shown by figures 18, 19, and 20.

c. Clean, inspect, and repair.

d. Adjust the main relay as shown by figure 21.

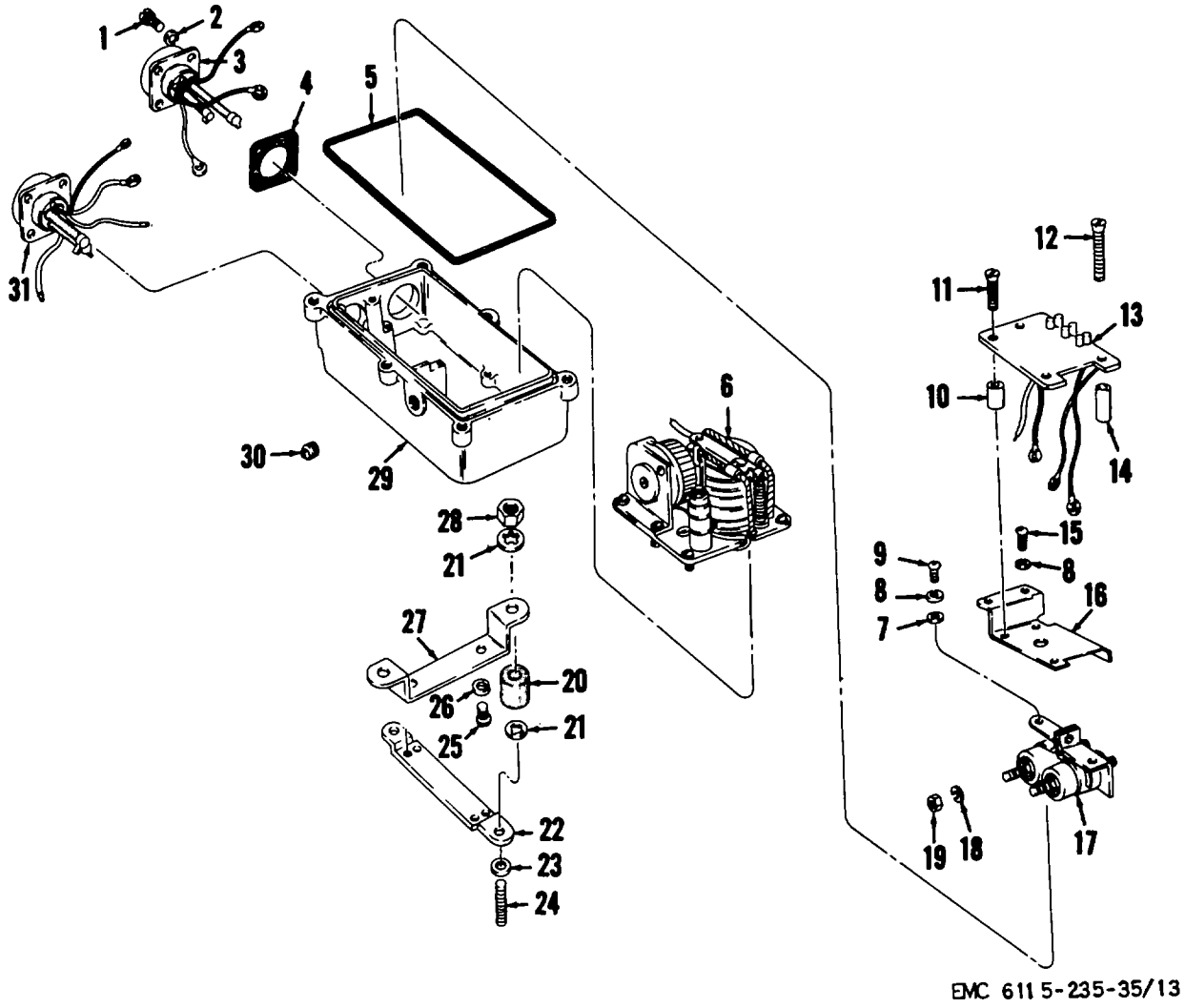
57. Testing and Adjusting Generator Regulator

***Caution*: Never allow the voltage to exceed 32 volts during these tests or the rectifier will be damaged. Unless otherwise stated, a battery must be connected in the load circuit at all times during the tests.**



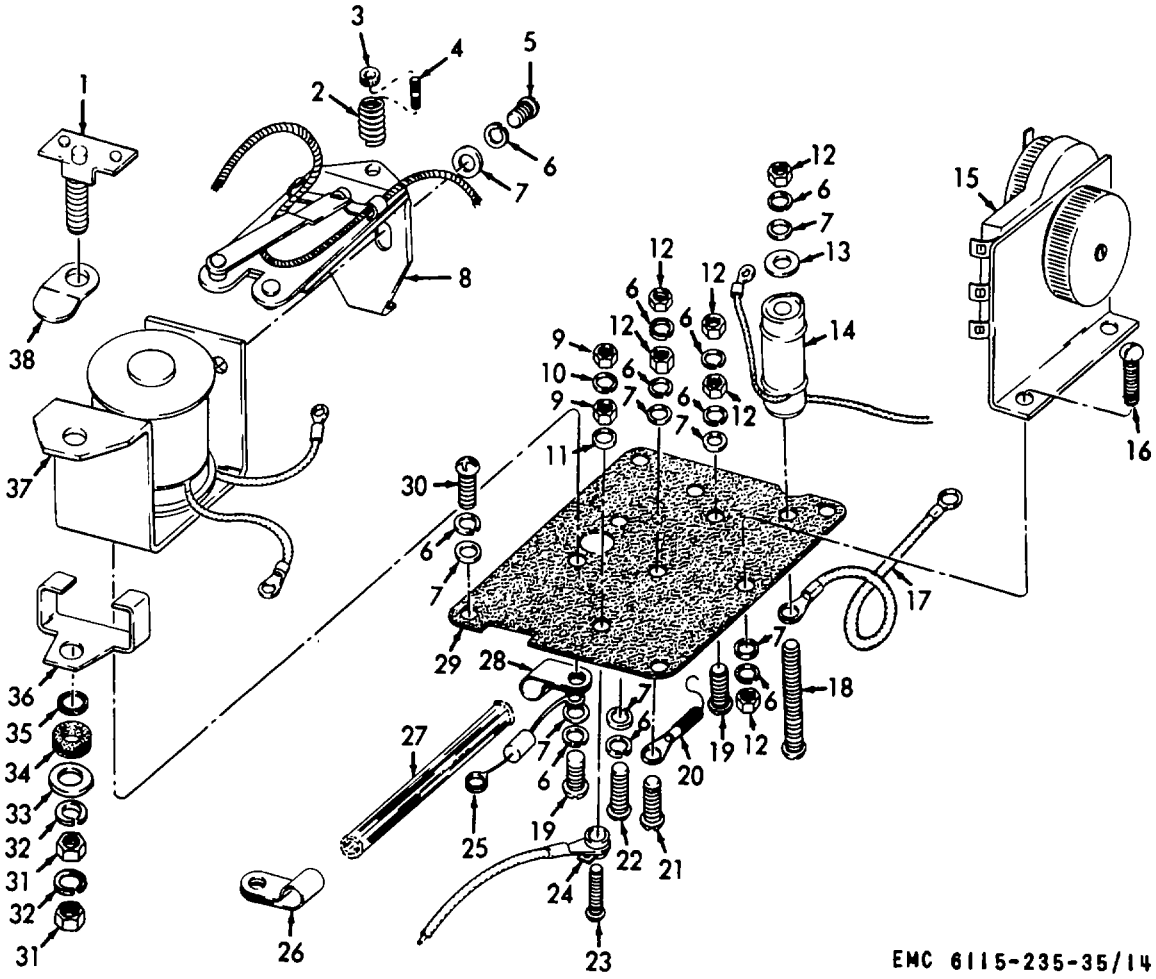
1 Disk and tube support cover
2 Screw, machine, No. 6-32 x 546 in. (4 rqr)
3 Washer, lock, No. 6 (5 rqr)
4 Screw, machine, No. 6-32 x Y2 in. (5 rqr)
5 Washer, lock, IT, No. 6 (8 rqr)
6 Washer, flat, No. 6 (2 rqr)
7 Insulator washer (2 rqr)
8 Insulator bushing (2 rqr)
9 Contact screw plate (2 rqr)
10 Insulator plate
11 Contact screw
12 Carbon pile tube
13 Carbon pile
14 Preformed packing (2 rqr)
15 Regulator element
16 Tab lock washer (spec)
17 Screw, machine, No. 6-32 x 3s6 in.
18 Preformed packing
19 Screw, machine, No. 6-32 x 1 in. (3 rqr)
20 Washer, lock, No. 10 (10 rqr)
21 Screw, machine, No. 10-32 x % in. (4 rqr)
22 End plate cover
23 Screw, machine, No. 10-32 x ¼ in.
24 Washer, flat, No. 10
25 Washer, lock, IT, No. 10
26 Coil pot end plate
27 Coil core
28 Paralleling coil
29 Operating coil
30 Coil pot
31 Shim (2 rqr)
32 Bimetal ring
33 Spacer
34 Armature
35 Screw, machine, No. 6-32 x N in. (4 rqr)
36 Contact panel
37 Contact panel spacer (4 rqr)
38 Regulator cover
39 Screw, machine, No. 10-32 x ¼ in. (6 rqr)
40 Plug, pipe, 4 in.
41 Contact screw electrical lead

Figure 18. Generator regulator cover, disassembly and reassembly.



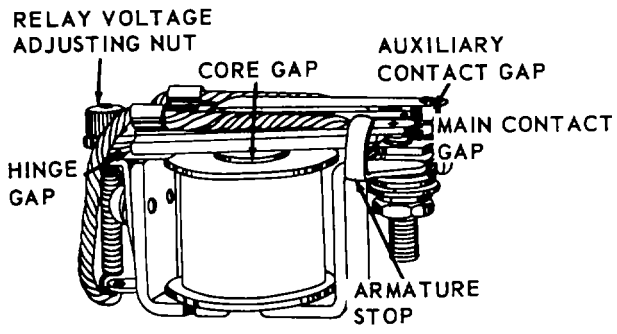
1	Screw, machine, fil-hd, No. 8-32 x ¼ in. (8 rqr)	17	Capacitor assembly
2	Washer, lock, No. 8 (8 rqr)	18	Washer, lock, ¼ in. (4 rqr)
3	Electrical receptacle	19	Nut, plain, hex, V4-20 (4 rqr)
4	Gasket (2 rqr)	20	Cushion (4 rqr)
5	Preformed packing	21	Washer, lock, IT, 566 in. (8 rqr)
6	Load relay assembly	22	Bracket (2 rqr)
7	Washer, flat, No. 6 (2 rqr)	23	Washer, flat, S5 in. (4 rqr)
8	Washer, lock, No. 6 (4 rqr)	24	Stud, s/(-24 x 2 in. (4 rqr)
9	Screw, machine, No. 6-32 x % in. (2 rqr)	25	Screw, machine, No. 10-32 x ¼ in. (4 rqr)
10	Regulator box spacer (3 rqr)	26	Washer, lock, No. 10 (4 rqr)
11	Screw, flat-hd, No. 6-32 x 17 in. (3 rqr)	21	Voltage regulator bracket (2 rqr)
12	Screw, flat-hd, No. 6-32 x 1 in.	28	Nut, plain, hex, 5/6-24 (4 rqr)
13	Regulator panel	29	Regulator box
14	Regulator box spacer	30	Plug, pipe, 4 in.
15	Screw, machine, No. 6-32 x 56 in. (2 rqr)	31	Electrical receptacle
16	Regulator shield		

Figure 19. Generator regulator box, disassembly and reassembly.



1	Contact plate	20	Resistor, 360-ohm
2	Helical torsion spring	21	Screw, machine, No. 10-32 x 4 in.
3	Adjusting nut (spec)	22	Screw, machine, No. 10-32 x 54 in.
4	Adjusting screw (spec)	23	Screw, machine, No. 4-40 x % in.
5	Screw, machine, No. 10-32 x ¼4 in. (2 rqr)	24	Rectifier
6	Washer, lock, No. 10 (12 rqr)	25	Resistor, 330-ohm
7	Washer, flat, No. 10 (11 rqr)	26	Terminal
8	Armature	27	Sleeve
9	Nut, plain, hex, No. 4-40 (2 rqr)	28	Clip (2 rqr)
10	Washer, lock, No. 4	29	Load relay panel
11	Washer, flat, No. 4	30	Screw, fil-hd, No. 10-32 x M in. (4 rqr)
12	Nut, plain, hex, No. 10-32 (7 rqr)	31	Nut, plain, hex, ¼-20 (2 rqr)
13	Insulating washer	32	Washer, lock, 4 in. (2 rqr)
14	Resistor, 18-ohm	33	Washer, flat, ¼ in. (2 rqr)
15	Adjustable resistor, 5-ohm	34	Insulating washer (2 rqr)
16	Screw, machine, No. 10-32 x M in. (2 rqr)	35	Insulating bushing (2 rqr)
17	Screw-to-load relay electrical lead	36	Armature stop
18	Screw, machine, No. 10-32 x 24 in. (2 rqr)	37	Coil assembly
19	Screw, machine, No. 10-32 x M in. (2 rqr)	38	Contact plate insulator (3 rqr)

Figure 20. Load relay, disassembly and reassembly.



HINGE GAP	.006 ± .002
CORE GAP	.028 ± .003
MAIN CONTACT GAP	.060 ± .002
AUXILIARY CONTACT GAP	.030 ± .002

EMC 6115-293-35/21

Figure 21. Main relay adjustments.

a. Load Relay Closing Voltage Adjustment. With the cover off, connect a 24-volt battery, variable resistor (0- to 100-ohm, 5-watt) and 0- to 50-volt de voltmeter across C and F pins of the 6-cable electrical receptacle. Slowly increase the voltage, by adjusting the variable resistor, until the relay closes. The correct closing voltage is 17 to 18 volts. Adjust the closing voltage, if necessary, by turning the relay voltage adjusting nut, as shown by figure 21, to increase or decrease the closing voltage.

b. Ground Test. Use a multimeter and test for continuity between the regulator box and each receptacle pin, in turn. No continuity should be indicated.

c. Operational Test and Adjustment.

(1) Test setup. Connect the generator regulator into the test circuit described in paragraph 53 for the battery-charging generator.

(2) Settling adjustment.

(a) Settling is defined as a form of lapping the carbons together by rapid vibration. This is accomplished by placing the generator regulator in a circuit which allows the carbon disks to vibrate under controlled conditions.

The vibration can be heard through an earphone connected as shown by figure 22. AGO 300A

(b) Remove the cover (par. 56) and connect for settling the carbon pile as shown in figure 22. Adjust the variable resistor so that a 0- to 50-volt voltmeter reads 12 to 14 volts. A crackle in the earphone or an erratic vibration indicates loose adjustment of the carbon pile. Remove the disk and tube support cover (par. 56) and tighten the carbon pile by turning the contact screw (11, fig. 18) clockwise just enough to eliminate the crackle and leave a distinct high-frequency hum. If the unit does not hum at the start of the operation, turn the contact screw counterclockwise until a hum begins. After the regulator is adjusted for settling, allow it to operate for 30 minutes, and listen occasionally to make sure that the hum does not stop. Remove the regulator cover from the test circuit.

(c) Install the regulator cover on the regulator box (par. 56) and operate the engine accessory generator at 1,000 rpm. Remove the pipe plug (30, fig. 19) from the regulator box and, working through the plug hole with a screwdriver, set the voltage regulator at 26.5 - 0.2 volts by turning the adjusting knob of the 5-ohm adjustable resistor assembly counterclockwise.

(d) Raise the voltage of the voltage regulator to 30.0 + 0.1 volts by turning the adjusting knob of the 5-ohm adjustable resistor assembly clockwise.

(e) Raise the engine accessory generator speed to 2,000 rpm, close the load switch, and adjust the load bank to give a load of 50 amperes. Set the regulator voltage to 28.0 + 0.1 volts by adjusting the 5-ohm adjustable resistor. Operate under these conditions for 30 minutes.

(3) Preliminary voltage adjustment.

(a) With the engine accessory generator operating at 1,000 rpm, turn the adjusting knob of the 5-ohm adjustable resistor assembly clockwise. Turn the contact screw (11, fig. 18) clockwise until a stable voltage is reached. As the screw is turned in, the voltage will

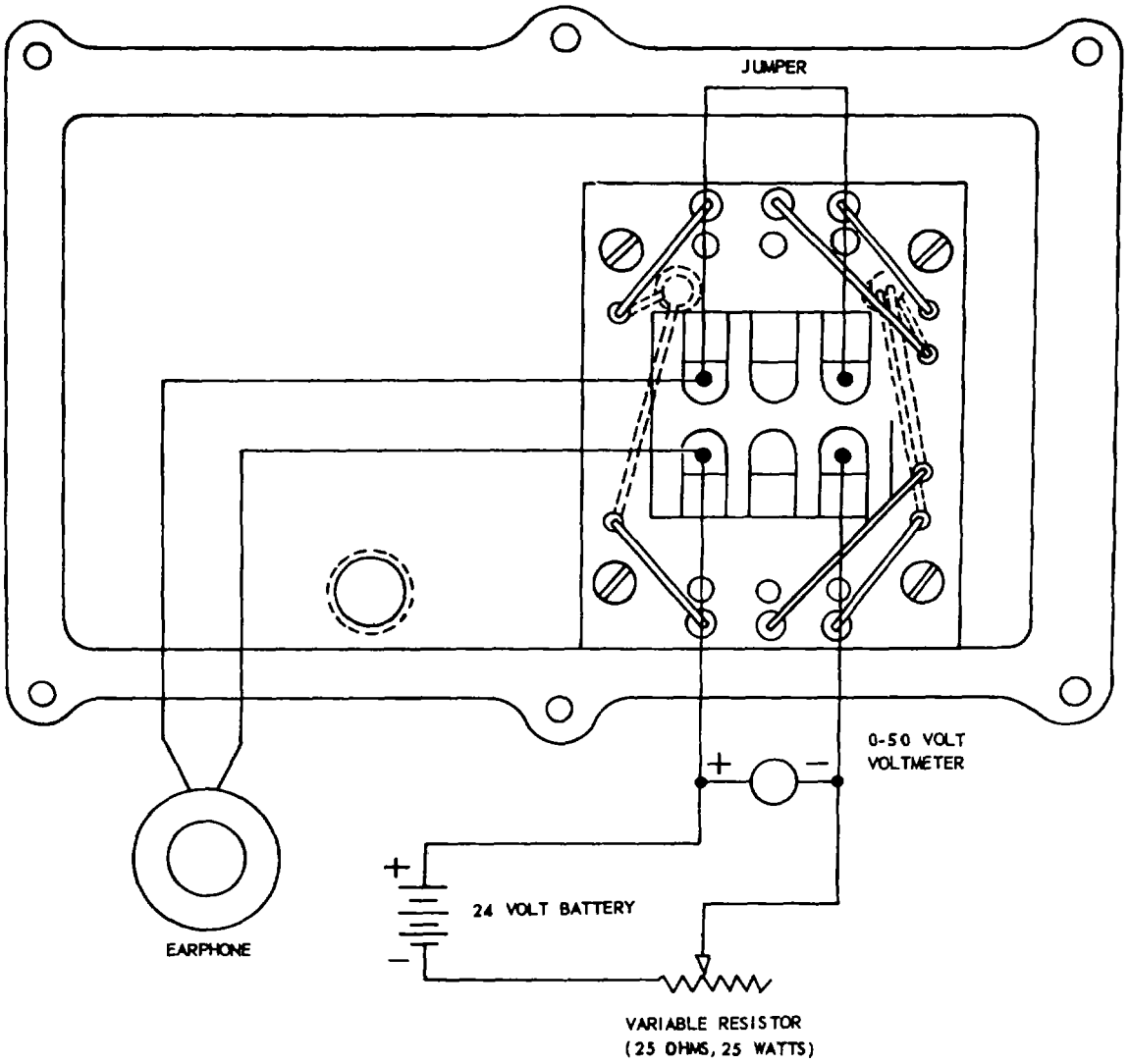


Figure. Setting carbon pile, wiring diagram.

rise, then drop, and then start to rise again. Proper point of adjustment is just before the voltage starts to rise the second time. Vary the load from the battery load to full load (100 amperes); the voltage should remain about the same.

(b) Remove the end plate cover (par. 56) and loosen the screw (23). Adjust the voltage regulator to 26.5 volts by turning the coil core (27). If the voltage is high, turn the coil core clockwise; if the voltage is low, turn the coil core counterclockwise. Turn the adjusting knob of the 5-ohm adjustable resistor from its completely counterclockwise position (minimum resistance) to its completely clockwise position (maximum resistance). The voltage range should be from 25.0 to 30.0 volts. Tighten the screw to secure the coil core.

Note. When the regulator is in proper adjustment, the paint marks on the coil core (27) and coil pot end plate (26) should not be more than one-eighth of a turn apart.

(c) Set the regulator voltage to 28.0 volts by means of the 5-ohm adjustable resistor. Apply a load of 100 amperes instantaneously and see that the voltage remains constant.

(d) Increase the engine accessory generator speed to 2,000 rpm and apply a full load of 100 amperes. The generator regulator voltage should remain at 28.0 + 0.5 volts. If the voltage drops when the full load is applied, turn the contact screw (11) counterclockwise, apply a load of 100 amperes instantaneously and check the voltage. If the voltage rises when the full load is applied, turn the contact screw clockwise, apply a load of 100 amperes instantaneously, and check the voltage. Repeat the procedure until the voltage remains at 28.0 + 0.5 volts under both battery and full load conditions.

(e) Increase the engine accessory generator speed to 6,000 rpm and apply a load of 100 amperes instantaneously. After applying several loads of 100 amperes instantaneously, the voltage should not rise or drop more than 0.5 volt. If voltage drops more than 0.5 volt, turn the contact screw (11) counterclockwise and apply a load of 100 amperes instantaneously. Check the voltage. Repeat the procedure until the voltage remains at 28.0 + 0.5 volts under both battery and full load conditions.

(f) Reduce the engine accessory generator speed at 3,200 rpm and apply a load of 100 amperes instantaneously several times. With battery load only, voltage should now read 28.0 - 0.2 volts.

(4) Final voltage adjustments.

(a) Operate the engine accessory generator at a speed of 2,000 rpm under a 100 ampere load. Reduce the engine accessory generator speed until the voltage regulator voltage is 26.4 to 26.6 volts and then measure the generator field current and carbon pile voltage. To measure the carbon pile voltage, connect a voltmeter across B and C pins of the five-cable receptacle. Divide the carbon pile voltage by the field current. The resultant value, which is the minimum resistance of the carbon pile, should not exceed 0.5 ohm.

(b) Increase the engine accessory generator speed to 6,000 rpm and check the voltage drop when a load of 100 ampere is applied. If the drop is less than 0.5 volt, remove the load reduce the engine accessory generator speed to 2,000 rpm, and turn the contact screw (11) counterclockwise. Check a 6,000 rpm and 100-ampere load for a 0.5 volt drop. Repeat until the correct voltage drop is obtained.

(c) Reduce the engine accessory generator speed to 4,000 rpm and shock the load with 100 amperes to settle the carbon pile. Adjust the regulator to 28 volts by means of the 5-ohm adjustable resistor.

(d) Repeat (b) and (c) above at least three times to assure consistent performance.

(e) Reduce the engine accessory generator speed to 1,000 rpm and remove all load, including the battery load, by opening the load switch and load relay switch. Check the voltage range by first turning the adjusting knob of the 5-ohm adjustable resistor completely counterclockwise and then turning it completely clockwise. Voltage range should be 25.5 to 30.0 volts. If the range is incorrect, adjust by loosening the screw (23) and turning the coil core (27). If the voltage is too high, turn the coil clockwise. If the voltage is too low, turn the coil core counterclockwise. Set the voltage at 28.0 volts by means of the 5-ohm adjustable resistor. Tighten the screw.

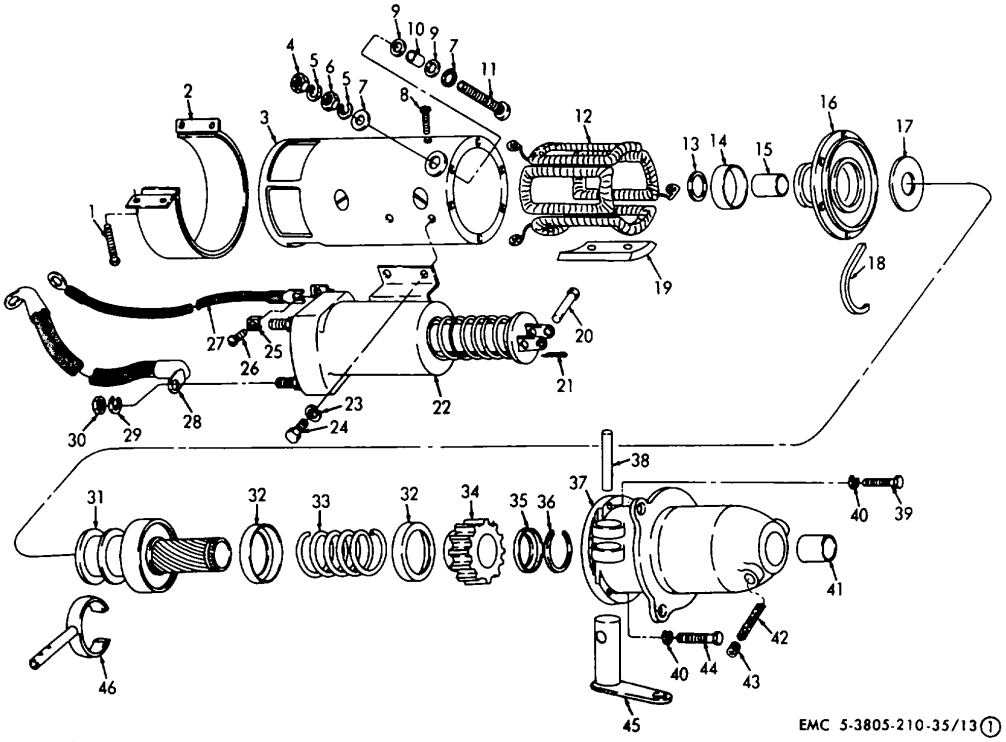
(f) Install the disk and tube support cover, pipe plug, and end plate cover (par. 56).

Section IV. STARTER

58. General

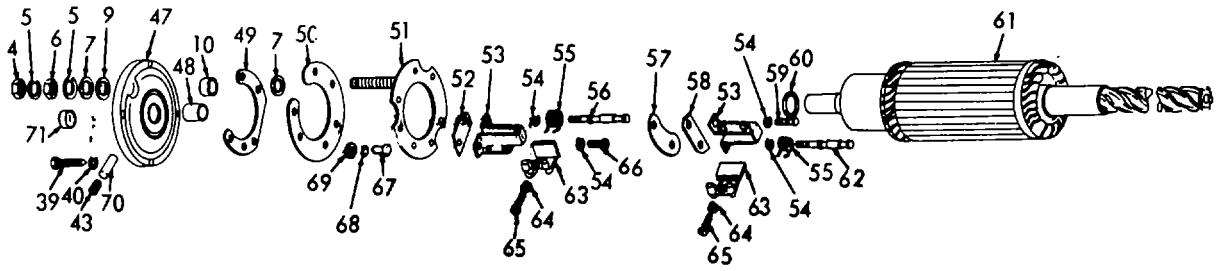
The starter is a heavy-duty, 24-volt unit flange mounted to the flywheel housing. The unit employs an overrunning clutch drive to mesh the drive pinion with the flywheel for cranking the engine and to release the drive pinion when the

engine begins to operate. The starter is composed of a commutator end frame, field frame, armature, overrunning clutch drive, and drive end frame. Current from the battery enters the starter's positive terminal and passes through the field coils, where it is picked up by a double set of commutator brushes and passed into the armature. From the armature, the current passes back through a second set of brushes to the battery. When the start switch is engaged, the armature begins to revolve, the drive pinion is shifted into mesh with the flywheel, and the cranking operation is started.



1 Screw (spec) (2 rqr)
2 Cover band
3 Field frame
4 Nut, plain, hex, s-ll x ¼ in. (2 rqr)
5 Washer, lock, Vs in. (4 rqr)
6 Nut, plain, hex, %-11 x , in. (2 rqr)
7 Washer, insulated, '/ in. (2 rqr)
8 Screw (spec) (8 rqr)
9 Washer, insulated, 4 x i in. (4 rqr)
10 Terminal stud bushing washer (2 rqr)
11 Field terminal stud
12 Field coil
13 Space collar
14 Wick retainer ring
15 Center bearing bushing
16 Center bearing
17 Brake washer
18 Center bearing wick
19 Pole shoe (4 rqr)
20 Shaft lever pin
21 Pin, cotter, 1 x S4 in.
22 Solenoid switch
23 Washer, lock,. 4 in. (4 rqr)
24 Screw, cap, 4-20 x ¼ in. (4 rqr)
25 Terminal clip (2 rqr)
26 Screw, machine, No. 10-32 x ¼ in. (2 rqr)
27 Solenoid terminal-to-field terminal lead
28 Solenoid terminal-to-commutator terminal cable
29 Washer, lock, ¼ in. (2 rqr)
30 Nut, hex, ¼-13 (2 rqr)
31 Sleeve and shaft
32 Spring retainer cup (2 rqr)
33 Meshing spring
34 Pinion
35 Pinion stop cup
36 Split washer
37 Drive end frame
38 Shifter yoke retaining pin
39 Screw, cap, ¼-20 x 1 in. (10 rqr)
40 Washer, lock, tang-type, ¼ in. (10 rqr)
41 Drive end bushing
42 Drive end wick
43 Pipe plug (spec) (2 rqr)
44 Screw, cap, ¼4-20 x 12 in.
45 Shift lever
46 Shifter yoke

Figure 23. Starter, disassembly and reassembly.



EMC 5-3805-210-35/13 (2)

47	Commutator end frame	60	Insulating brake washer
48	Bushing	61	Armature
49	Brush holder support plate	62	Long grounded brush holder screw (2 rqr)
50	Insulated brush plate	63	Brush (8 rqr)
51	Brush plate and stud	64	Washer, lock (spec) (8 rqr)
52	Brush holder space plate (2 rqr)	65	Machine screw (spec) (8 rqr)
53	Brush holder (4 rqr)	66	Insulated brush holder machine screw (spec) (2 rqr)
54	Insulated lock washer (spec) (8 rqr)	67	Screw, machine, No. 10-32 x X in. (3 rqr)
55	Brush spring (4 rqr)	68	Washer, lock, No. 10 (3 rqr)
56	Long insulator brush holder screw (spec) (2 rqr)	69	Washer, flat, No. 10 (3 rqr)
57	Insulated brush holder plate (2 rqr)	70	Commutator end frame wick
58	Grounded brush holder space plate (2 rqr)	71	End cap
59	Brush holder ground machine screw (spec) (2 rqr)		

Figure 23. Starter, disassembly and reassembly-Continued.

As soon as the engine starts, the reversal torque releases the starter pinion from the flywheel.

59. Starter

a. Remove and install the starter (TM 5-6115293-12).

b. Disassemble and reassemble the starter as, shown by figure 23.

c. Test the armature on a growler for shorts, opens, and grounds as instructed in TM 5-764. Replace a defective armature. Test the field coils with a multimeter for continuity and grounds as instructed in TM 5-764. Replace a defective field coil. Use a multimeter and test for continuity between the insulated brush holders and the endbell. If continuity is indicated, the endbell is defective and must be replaced.

d. Clean, inspect, and repair.

e. After reassembly, but before installation, bench test the engine electrical starter as follows:

(1) *No-load test.* Connect a 24-volt battery in series with a load rheostat and an ammeter shunt of a capacity greater than 300 amperes and connect the group between the starter terminal and the field frame. Connect an ammeter to the shunt AGO 300A and a voltmeter to the starter terminal and the field frame. With the voltage adjusted to 23.5 volts, the current should be 35 amperes maximum at a minimum speed of 2,500 rpm by use of a speed indicator. If the current and speed are both low, inspect for high resistance in the internal connections. If the current is high and the speed is low, inspect the bearing and armature for binding and incorrect alinement.

(2) *Stall torque test.* With the starter connected, as in (1) above, fasten a torque arm and a spring scale to the armature at the drive end. Adjust the rheostat to give 19.1 volts. The correct readings are 265 amperes maximum and a stall torque of 19 ft-lb minimum. The stall torque is the product of the spring scale reading in pounds, multiplied by the length of the toque arm in feet. If the current and torque are both low, inspect for high resistance in internal connections and for improper brush contact. High current and low torque may be caused by a defective armature or field coil.

Section V. WATER PUMP

60. General

The engine water pump is a centrifugal-type pump, driven by a coupling mated to an adapter on the blower shaft. The water pump draws coolant from the radiator through the engine oil cooler and into the lower part of the cylinder block.

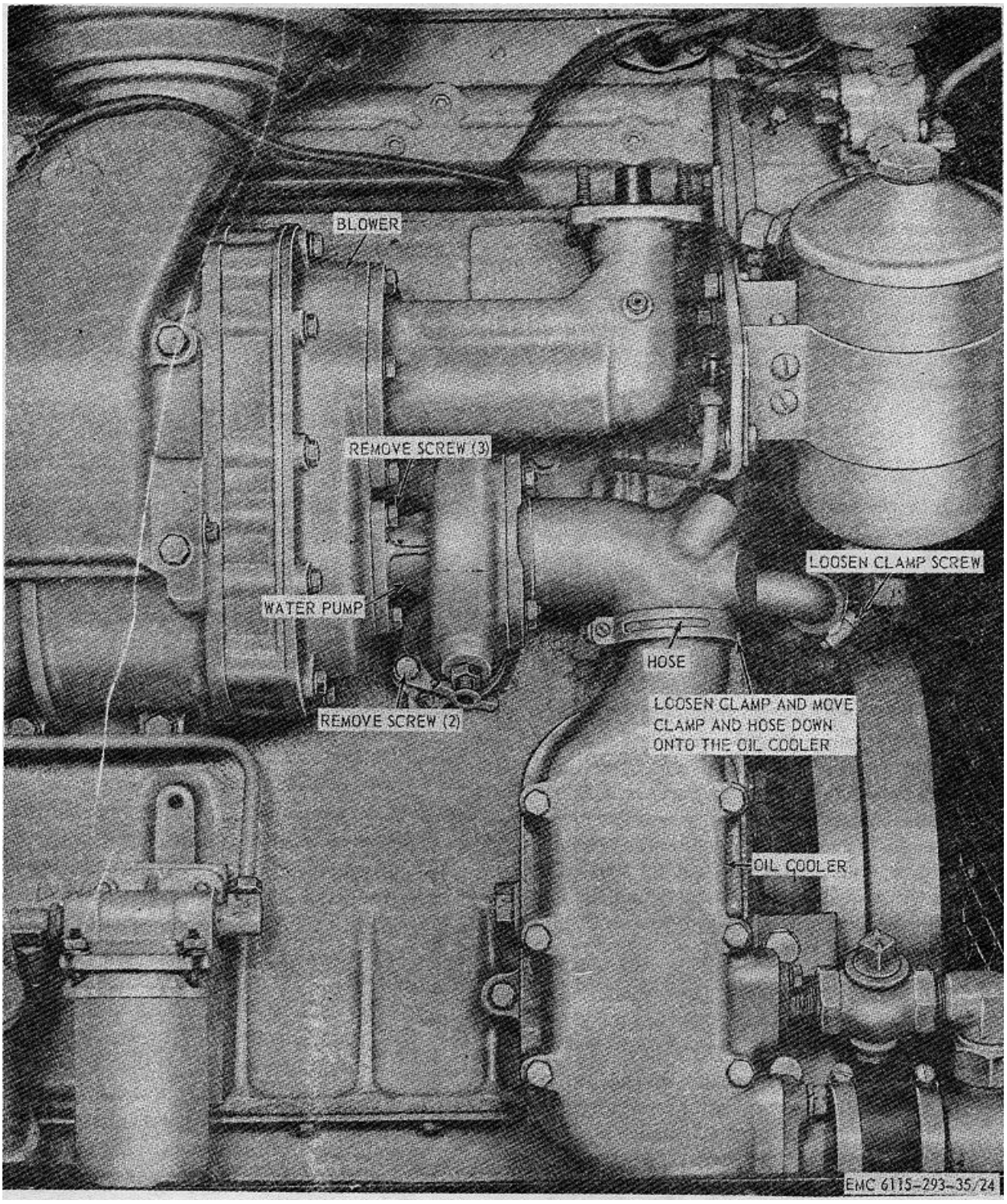


Figure 24. Water pump, removal ana installation.

A thermostat in the cooling system controls a valve which bypasses the radiator during cold-weather operation.

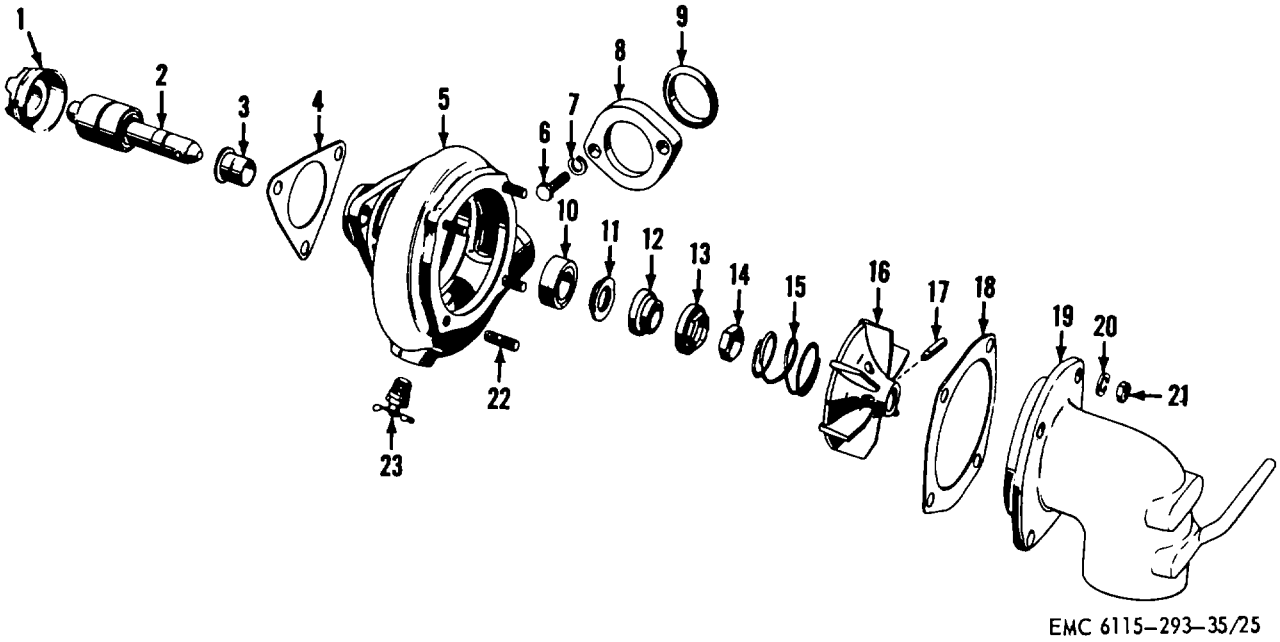
61. Water Pump

a. Drain and fill the radiator (TM 5-6115-29312).

b. Remove and install the water pump as shown by figure 24.

c. Disassemble and reassemble the water pump as shown by figure 25.

d. Clean, inspect, and repair.



1	Coupler	13	Seal
2	Thrower and shaft	14	Spacer
3	Slinger	15	Spring
4	Gasket	16	Impeller
5	Body	17	Pin (spec)
6	Bolt, hex-hd, 56-18 x 1, in. (2 rqr)	18	Gasket
7	Washer, lock, K in. (2 rqr)	19	Cover
8	Flange	20	Washer, lock, V4 in. (4 rqr)
9	Packing	21	Nut, plain, hex, Y4-28 (4 rqr)
10	Bearing	22	Stud, plain, Y-20 x V-28 x 1 1/16, in. (4 rqr)
11	Insert	23	Cock
12	Insert body		

Figure 25. Water pump, disassembly and reassembly.

Section VI. AIR INLET HOUSING, BLOWER, AND ACCESSORY DRIVE

62. General

The air inlet housing contains the blower screen and shutdown valves. It provides mounting for the air cleaners. The blower is driven by the accessory drive which, in turn, is driven by the engine gear train. The blower is especially designed for efficient diesel operation, supplying fresh air to the engine for combustion of fuel and for scavenging of the exhaust gases. Two rotors, with three helical lobes each, revolve at high speed, with very close tolerances, in a blower housing bolted to the cylinder block. The blower gears and bearings are lubricated by oil draining from the valve-operating mechanism. Oil seals in the blower and covers restrict air leakage and prevent lubricating oil from entering the rotor compartment.

63. Air Inlet Housing

a. Remove and install the air inlet housing as shown by figure 26.

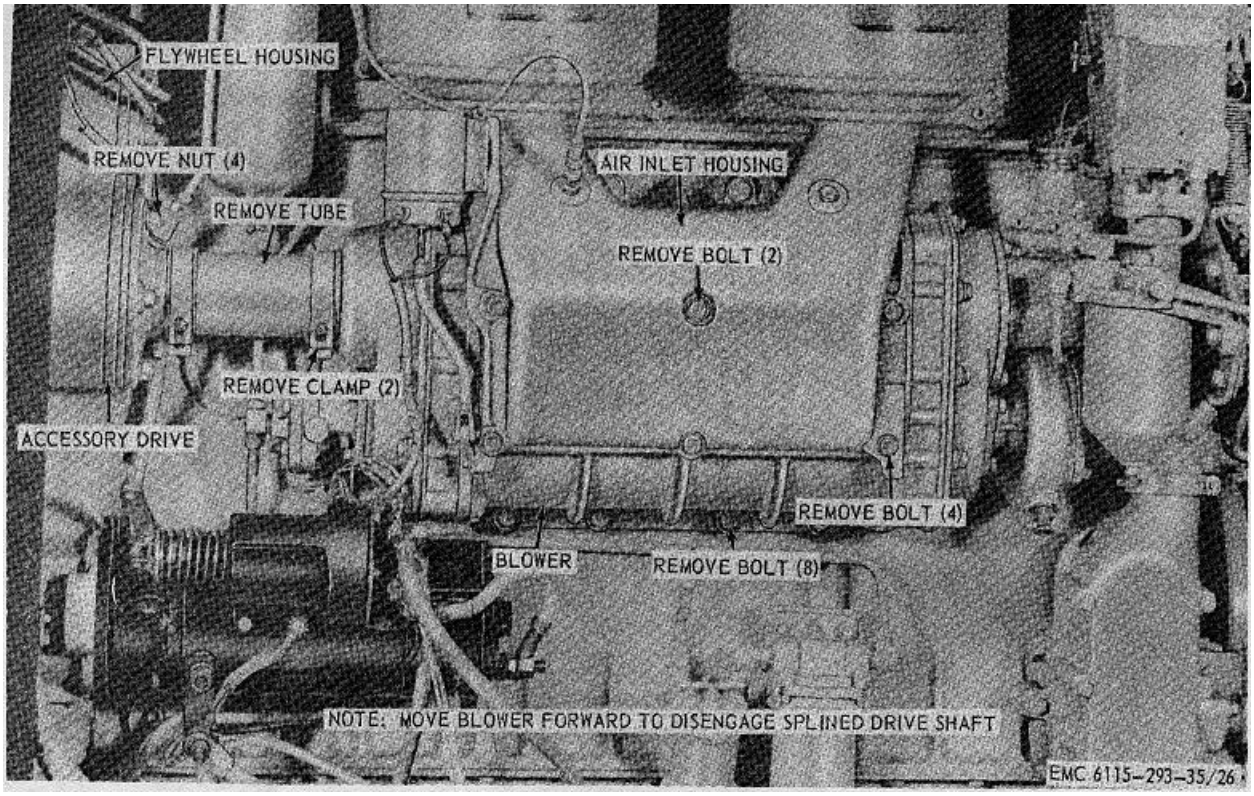


Figure 26. Air inlet housing, blower, and accessory drive, removal and installation.

b. Disassemble and reassemble the air inlet housing as shown by figure 27.

c. Clean, inspect, and repair.

64. Blower

a. Remove and install the air inlet housing (par. 63)

b. Remove and install the blower as shown by figure 26.

c. Disassemble and reassemble the blower as shown by figure 28.

d. Clean, inspect, and repair.

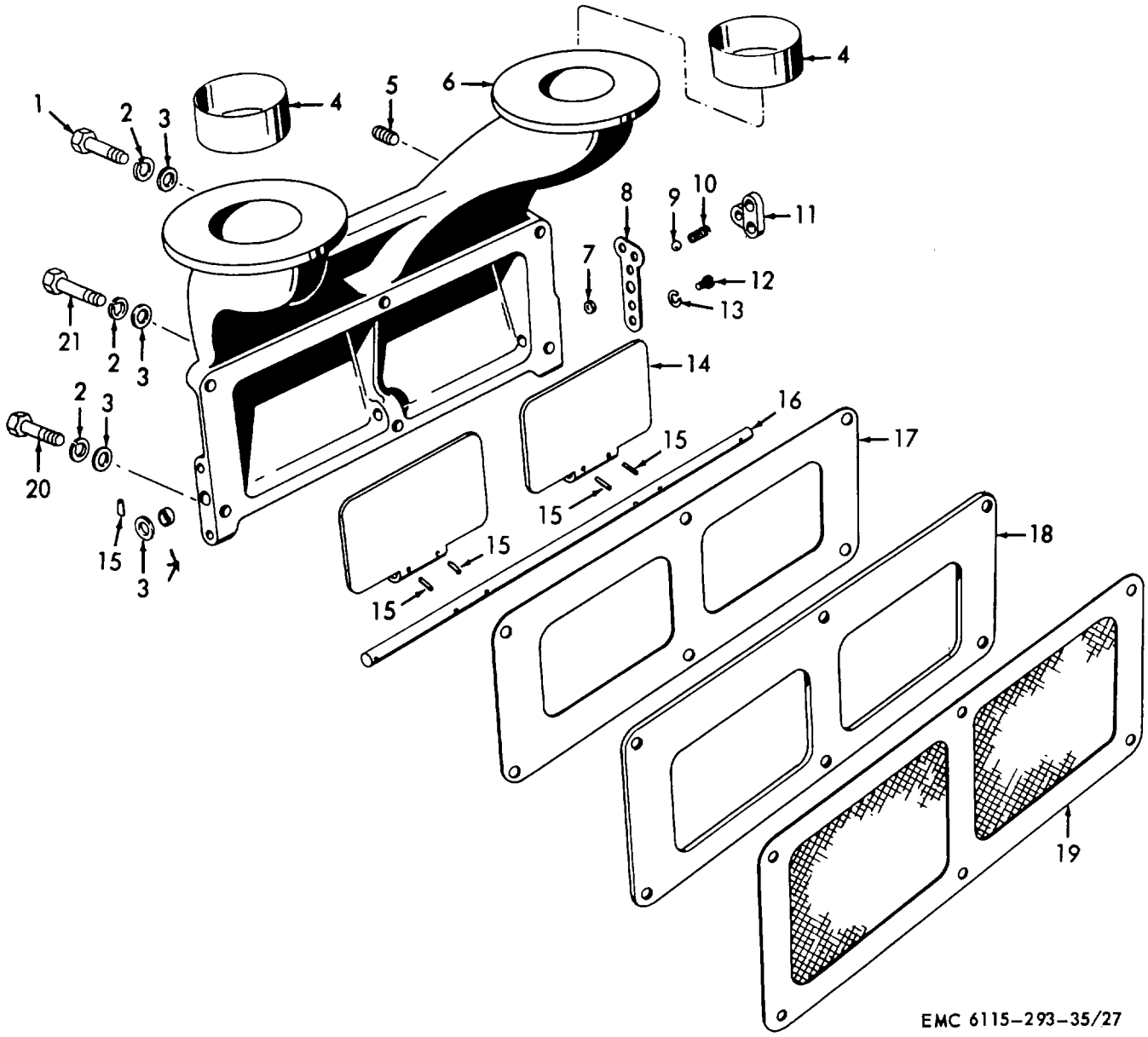
65. Accessory Drive

a. Remove and install the blower (par. 64).

b. Remove and install the accessory drive as shown by figure 26.

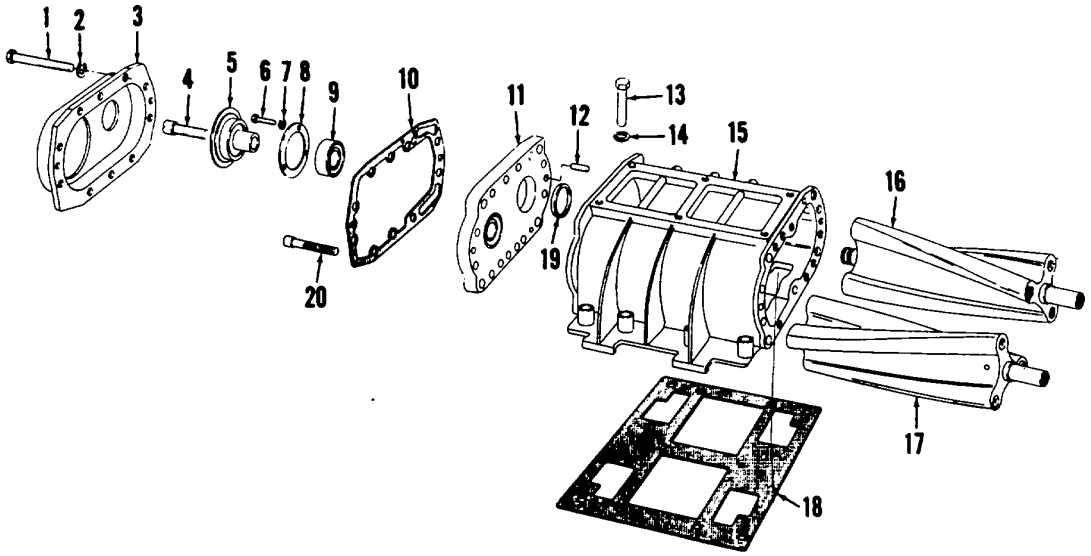
c. Disassemble and reassemble the accessory drive as shown by figure 29.

d. Clean, inspect, and repair.



1	Screw, cap, hex-hd, s--16 x 2Y4 in. (2 rqr)	12	Screw, cap, hex-hd, ¼-20 x ¼ in. (2 rqr)
2	Washer, lock, x4 in. (14 rqr)	13	Washer, lock, ¼ in. (2 rqr)
3	Washer, flat, '8 in. (15 rqr)	14	Shutdown valve (2 rqr)
4	Tube (2 rqr)	15	Pin, roll, 16 x 1/2 in. (6 rqr)
5	Plug, pipe, socket-hd, ¼-18	16	Valve shaft
6	Housing	17	Gasket
7	Valve shaft seal (2 rqr)	18	Plate
8	Plate	19	Blower screen
9	Bearing ball	20	Screw, cap, hex-hd, 3/8-16 x 1-5' in. (8 rqr)
10	Helical spring	21	Screw, cap, hex-hd, 3/-16 x 2 in. (4 rqr)
11	Valve lever		

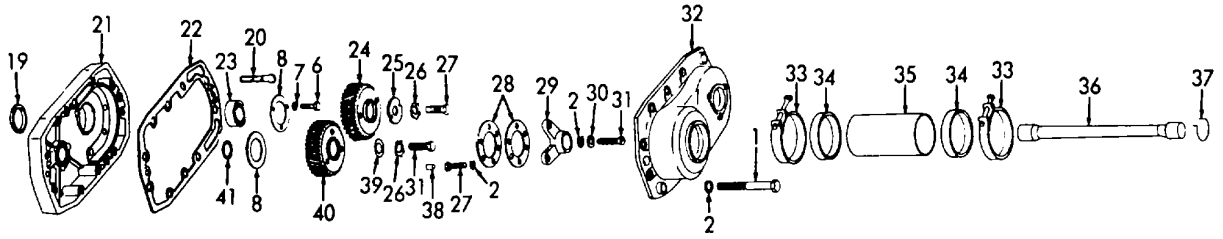
Figure 27. Air inlet housing, disassembly and reassembly.



EMC 5-4310-219-35/8 (1)

1	Bolt, hex-hd, fs--18 x 34 in. (20 rqr)	11	Front end plate cover
2	Washer, lock, s6 in. (26 rqr)	12	Dowel (4 rqr)
3	Front plate cover	13	Bolt, hex-hd, s-14 x 2 in. (8 rqr)
4	Bolt, socket-hd, K54-24 x 1¼% in.	14	Washer, lock, 76 in. (8 rqr)
5	Water pump drive coupling	15	Blower housing
6	Screw, cap, 4-20 x ¼ in. (12 rqr)	16	Left-hand rotor
7	Washer, lock, ¼ in. (12 rqr)	17	Right-hand rotor
8	Bearing retainer (4 rqr)	18	Blower housing gasket
9	Bearing (2 rqr)	19	Seal (4 rqr)
10	Front end plate cover gasket	20	Bolt, hex-hd, 54-18 x 1 M in. (4 rqr

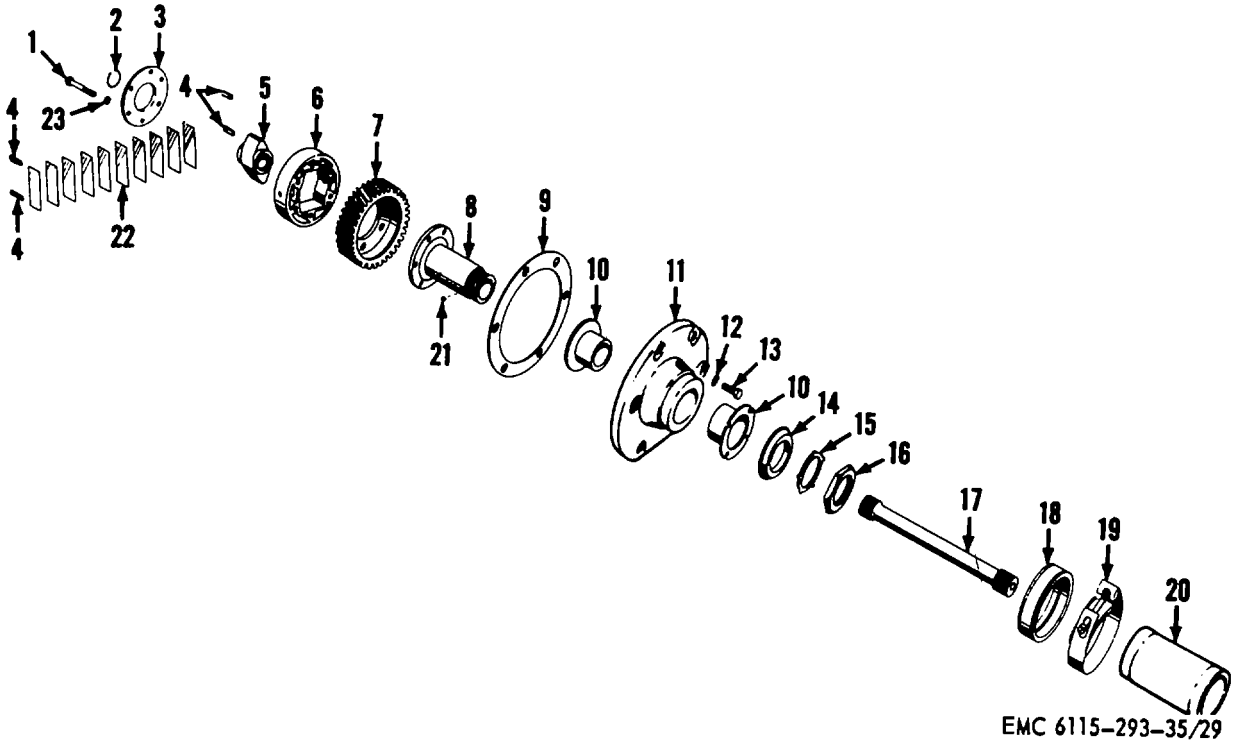
Figure 28. Blower, disassembly and reassembly.



EMC 5-4310-219-35/8 (2)

21	Rear end plate cover	32	Rear plate cover
22	Rear end plate cover gasket	33	Packing clamp
23	Bearing (2 rqr)	34	Packing (2 rqr)
24	Left-hand rotor gear	35	Blower drive cover
25	Fuel pump coupling disk	36	Blower drive shaft
26	Washer (spec) (2 rqr)	37	Snapring
27	Bolt (spec) (2 rqr)	38	Spacer (3 rqr)
28	Plate (2 rqr)	39	Gear retaining washer
29	Blower rotor hub	40	Right-hand rotor gear
30	Washer (spec) (2 rqr)	41	Shim
31	Screw, cap, 5f-18 x 3 in. (6 rqr)		

Figure 28. Blower, disassembly and reassembly-Continued.



1 Bolt, machine, hex-hd, 5/16-24 x 1 15/16 in. (6 rqr)
2 Retaining ring
3 Retainer
4 Spring seat (4 rqr)
5 Drive coupling cam
6 Coupling support
7 Helical gear
8 Blower drive gear hub
9 Gasket
10 Bearing (2 rqr)
11 Hub support
12 Washer, lock, 3/8 in. (2 rqr)
13 Screw, cap, hex-hd, 3/8 24 x 7/8 in. (2 rqr)
14 Thrust washer (spec)
15 Washer key
16 Nut, plain, hex, 1½-16
17 Blower drive shaft
18 Seal (2 rqr)
19 Hose clamp (2 rqr)
20 Tube
21 Bearing ball
22 Spring (10 rqr)
23 Washer, lock, 5/16 in. (6 rqr)

Figure 29. Accessory drive, disassembly and reassembly.

Section VII. FUEL INJECTOR PUMP

66. General

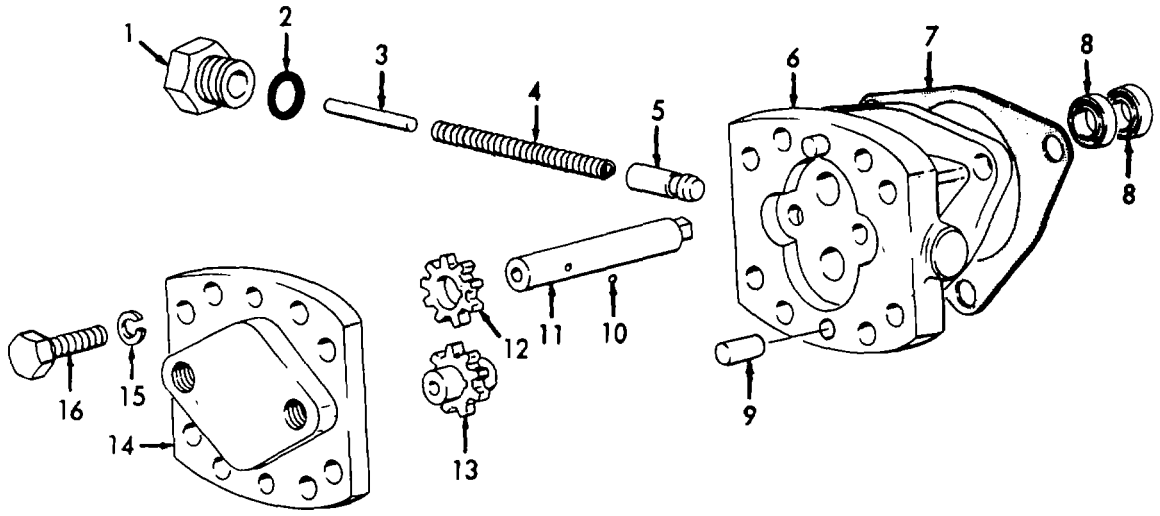
The fuel injector pump is a positive-displacement, gear type. The pump is attached to the blower and is driven by the blower gears. The pump gears have a pressed fit on the drive shaft. A spring-loaded relief valve, incorporated in the pump body, normally remains closed and opens only when the pressure in the pump rises above 65 psi. The fuel is then returned through a passage in the body from the pressure side to the suction side of the pump. Two oil seals are pressed into the bore in the flange side of the body, with the feather-edge of the seals facing away from the fuel pump gears.

67. Fuel Injector Pump

a. Remove and install the fuel injector pump (TM 5-6115-293-12).

b. Disassemble and reassemble the fuel injector pump as shown by figure 30.

c. Clean, inspect, and repair.



EMC 6115–293–35/30

1 Valve plug
2 Gasket
3 Pin, straight, headless, 5/32 x 1 in.
4 Spring
5 Fuel valve
6 Body
7 Gasket
8 Seal (2 rqr)
9 Pin, straight, headless, ¼ x 5/8 in. (2 rqr)
10 Bearing ball
11 Shaft
12 Spur gear
13 Driven gear and shaft
14 Cover
15 Washer, lock, ¼ in. (8 rqr)
16 Screw, cap, hex-hd, ¼-20 x ¾ in. (8 rqr)

Figure 30. Fuel injector pump, disassembly and reassembly.

Section VIII. FUEL TRANSFER PUMP

68. General

The fuel transfer pump is provided to pump fuel from the fuel tank into the reservoir. It is mounted on the rear of the engine and driven by the balancer shaft gears. The pump consists of a rotor, idler gear, and a crescent-shaped partition, which is cast integrally into the cover. Power is applied to the rotor and is transmitted to the idler gear with which it meshes. Fuel is drawn into the pump through the suction port, out through the discharge port, and into the reservoir.

69. Fuel Transfer Pump

a. Remove and install the fuel transfer pump as shown by figure 31.

b. Disassemble and reassemble the fuel transfer pump as shown by figure 32.

c. Clean, inspect, and repair.

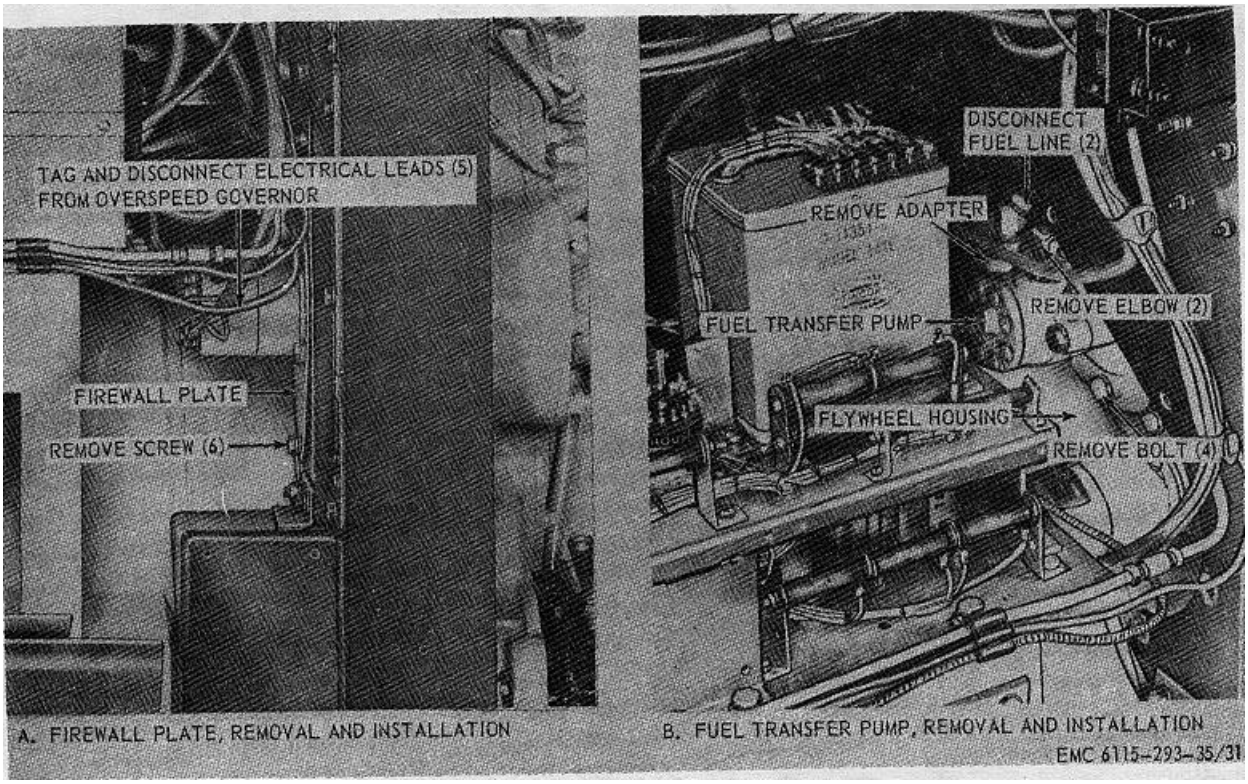
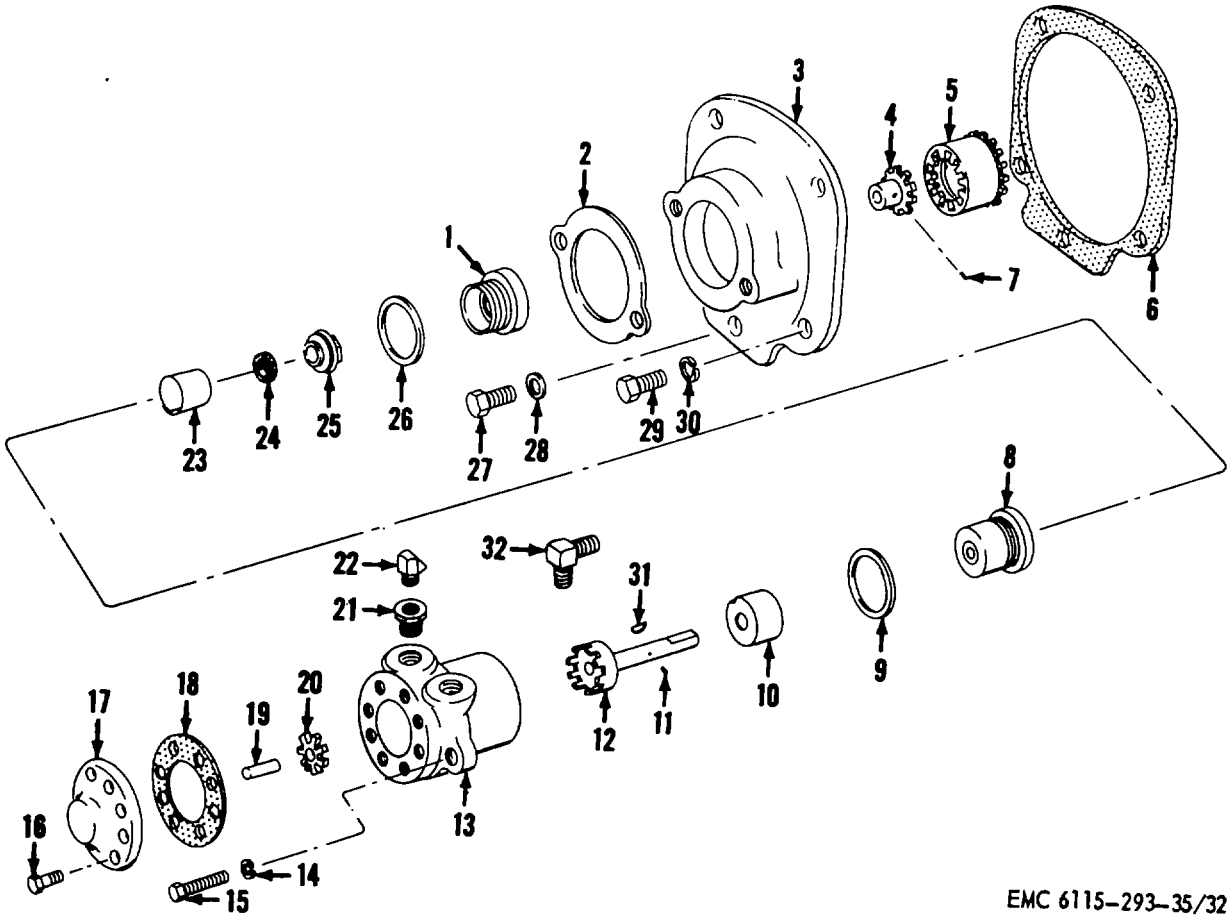


Figure 31. Firewall plate and fuel transfer pump, removal and installation.



1 Housing plug cap
2 Gasket
3 Pump drive adapter
4 Pump drive gear
5 Pump drive coupling
6 Gasket
7 Setscrew, socket-hd, No. 10-32 x 5/16 in.
8 Plug (spec)
9 Gasket
10 Rotor
11 Pin (spec)
12 Drive shaft
13 Housing
14 Washer, lock, 7/16 in. (2 rqr)
15 Screw, cap, hex-hd, 7/16-14 x 1¼ in. (2 rqr)
16 Screw, cap, hex-hd, ¼-20 x 1 in. (8 rqr)
17 Cover
18 Gasket
19 Idler gear pin
20 Idler gear
21 Bushing, ¼ in. pipe-to-3/8 in. pipe (2 rqr)
22 Elbow, 45°, 3/8 in. tubing-to-¼ in. pipe
23 Bushing
24 Felt washer (spec)
25 Seal
26 Cap gasket
27 Screw, cap, hex-hd, 3/8-16 x 7/8 in.
28 Washer, flat, copper, 3/8 in .
29 Screw, cap, hex-hd, ½ -13 x 1¼ in. (4 rqr)
30 Washer, lock, ½ in. (4 rqr)
31 Key, woodruff, No. 1
32 Elbow, 90°, 3/8 in. tubing-to-¼ in. pipe

Figure 32. Fuel transfer pump, disassembly and reassembly.

Section IX. FUEL RESERVOIR

70. General

The fuel reservoir provides a ready fuel supply for the fuel injector pump. The fuel reservoir is a steel tank of welded construction.

71. Fuel Reservoir

a. Remove and install the fuel reservoir as shown by figure 33.

b. Clean and inspect.

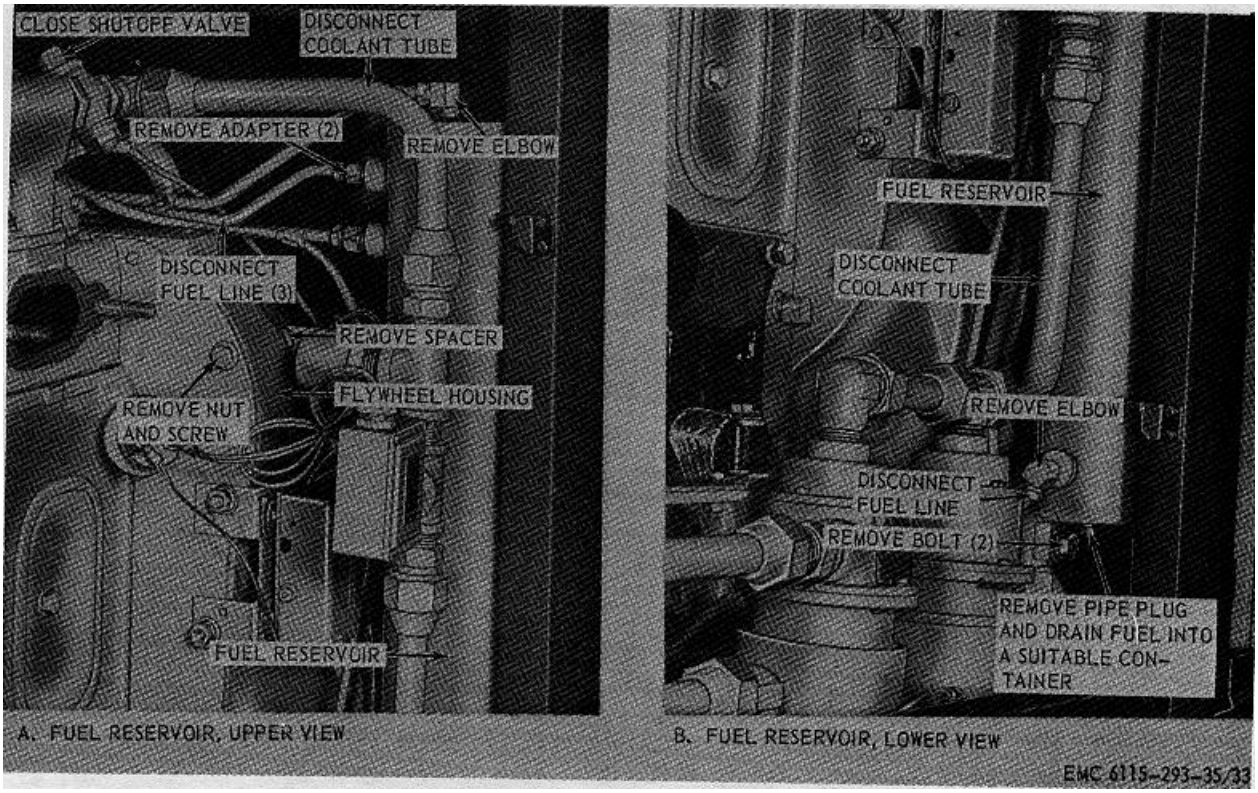


Figure 33. Fuel reservoir, removal and installation.

Section X. FUEL INJECTORS

72. General

To insure combustion, a small quantity of accurately metered, finely atomized fuel must be mixed, at the end of the combustion stroke, with a charge of air which has been forced into the cylinder by the blower. This mixing is accomplished by a high-pressure fuel injector. Before injection can be effected, the fuel pressure must be higher than that of the air charge in the combustion chamber. The fuel injector meters and injects fuel. Second, it creates high fuel pressure. Third, it atomizes the fuel. Lastly, continuous bypass of fuel through the injector body acts as a coolant and eliminates air pockets. The fuel injector combines, in a single unit, all the parts necessary to perform the above functions; thus providing a complete and independent injection system for each engine cylinder. The fuel injector consists of the following major components: the lifter guide, lifter spring, injector body, nut, spray tip, rack, and filter caps.

73. Fuel Injectors

a. Remove and install the rocker arm cover fuel control tube and lever (TM 5-6115-293-12).

b. Remove and install the fuel injectors as shown by figure 34.

c. Adjust the fuel control tube and lever (TM 5-6115-293-12).

d. Disassemble and reassemble the fuel injectors as shown by figure 35.

e. Clean, inspect, and repair.

f. Test the injector as follows:

(1) Test the spray tip runout with a suitable dial indicator. Total runout must not exceed 0.008 inch. If the runout exceeds 0.008 inch, loosen retaining nut (19, fig. 35) and recenter nozzle tip (16) in the nut. Tighten nut, recheck runout, and repeat the procedure until correct runout is established, or replace as necessary.

(2) Hold the injector in a horizontal position with the coupling end of the control rack

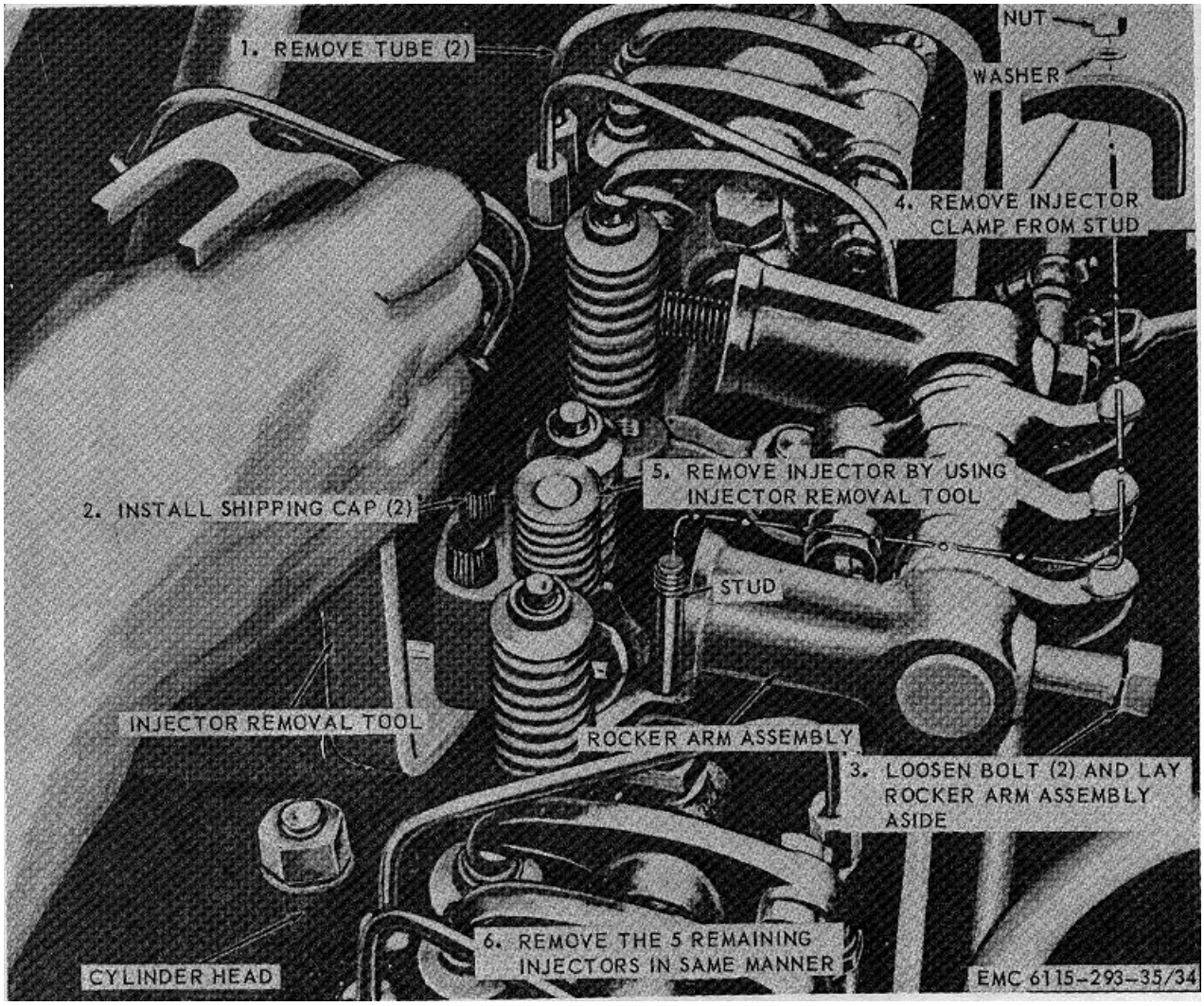
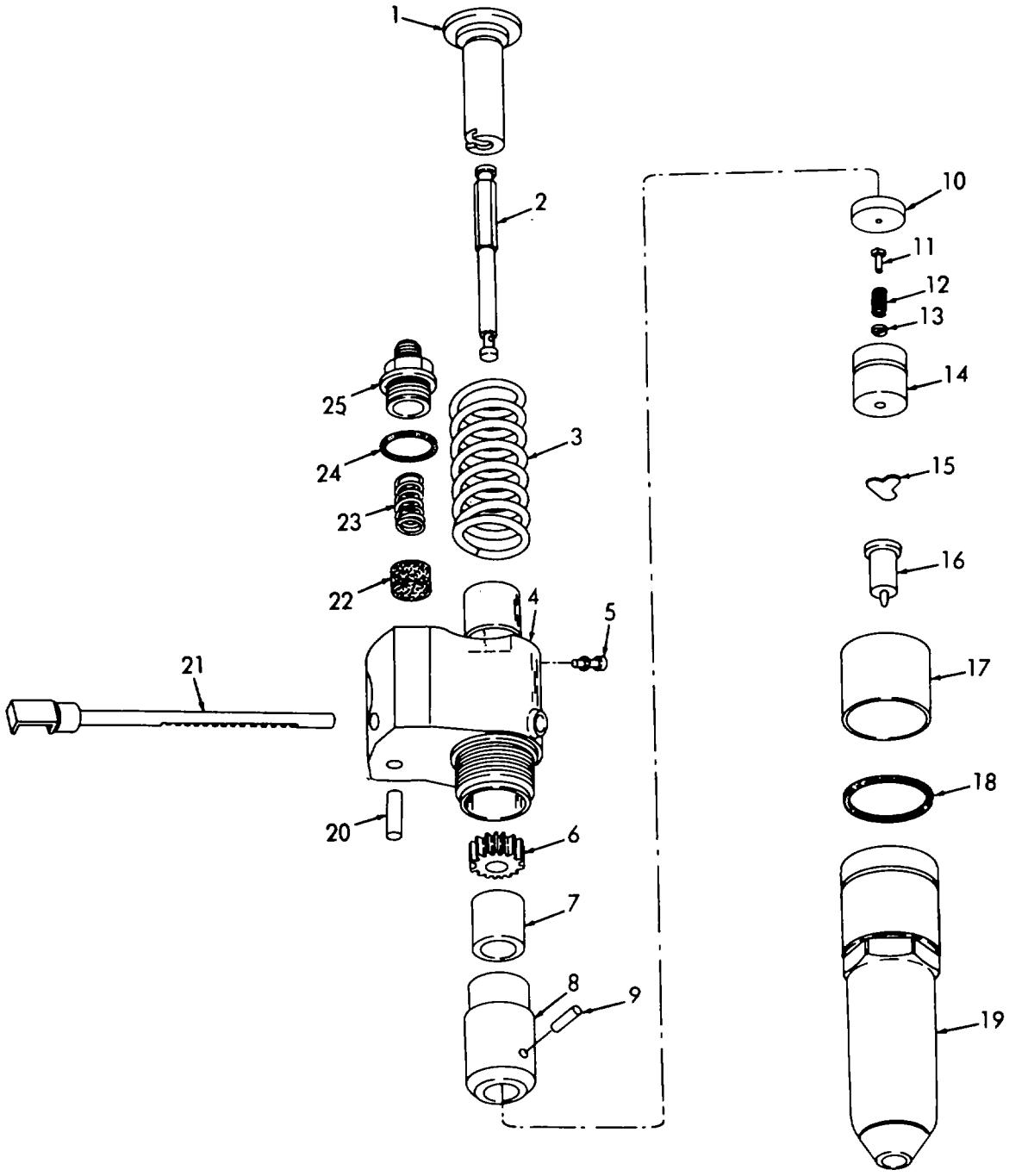


Figure 34. Fuel injector, removal and installation.

---

1 Follower
2 Plunger
3 Spring
4 Body
5 Stop pin
6 Spur gear
7 Retainer
8 Bushing
9 Pin (spec)
10 Seat
11 Valve
12 Spring
13 Stop
14 Cage
15 Valve
16 Tip
17 Deflector
18 Seal
19 Nut (spec)
20 Pin (spec)
21 Rack
22 Filter (2 rqr)
23 Spring (2 rqr)
24 Gasket (2 rqr)
25 Cap (2 rqr)

Figure 35. Fuel injector, disassembly and reassembly.



EMC 6115-293-35/35

Figure 35-Continued.

(21) pointing upward. Quickly invert the injector so the coupling end points downward. The rack should move freely through its full travel by means of its own weight. To correct improper rack travel, loosen retaining nut, rotate tip, tighten nut, and recheck rack travel. Repeat the procedure as necessary until proper freedom of travel is established. If necessary, disassemble and reassemble the assembly, recheck, or replace as necessary.

(3) Install the injector in a holding device with the top side up. Position the control rack in the full fuel position, no fuel position, and midway between. Depress the follower, release, and check for free return of the follower with the rack in each position. To correct the lack of free return, disassemble and reassemble the injector, and recheck the follower return. Replace as necessary.

***Warning*: When testing the fuel injectors for spray characteristics, keep hands away from the nozzle spray. The high velocity spray may puncture the skin and cause blood poisoning.**

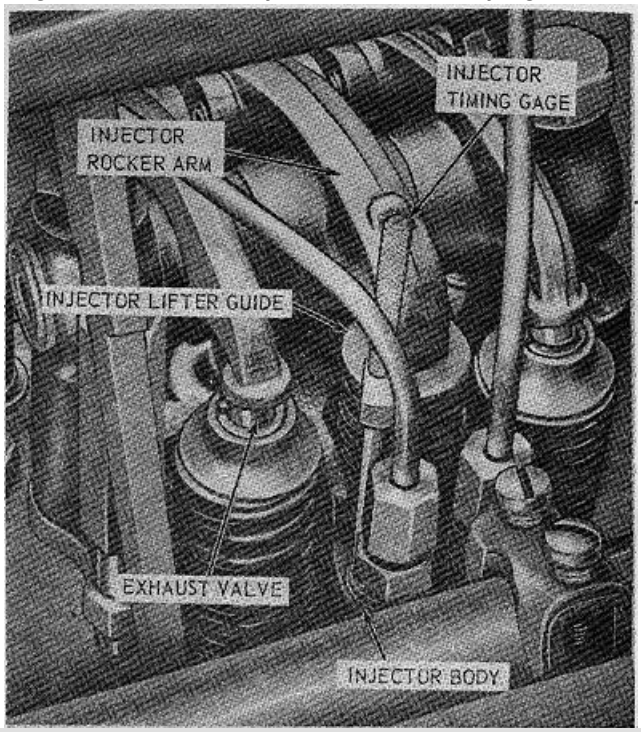
(4) Install the injector in the injector test fixture. Position the control rack in the full fuel position and check each nozzle tip orifice for equal fuel discharge. Unequal fuel discharge can be corrected by replacing the injector if necessary.

(5) Check the pressure on the test fixture when the injector discharges fuel. The pressure should be from 350 to 850 psi. Valve opening pressure below 350 psi indicates a defective spring. Recheck the valve opening pressure and replace the injector if necessary.

(6) Dry the injector with a clean, lint-free cloth. Establish pressure on the injector to a point just below the valve opening pressure determined in step (5) above and close the pump valve. Check the time required for the pressure to drop from 350 to 150 psi. This time should be a 50second minimum for a new injector or a 35-second minimum for a used injector. If the time is less than the minimum stated above, inspect the injector for moist areas to determine the source of leaks. Leakage around the seal (18) at the retaining nut (19) indicates a loose retaining nut. Leakage at the rack opening in the injector body indicates excessive clearance between the plunger (2) and bushing (8) or between the bushing (8) and body (4). Leakage at the nozzle tip (16) indicates defective parts listed in step (4) above. Repair or replace a defective injector as necessary

(7) Test the remaining fuel injectors in the same manner.

g. Time the fuel injectors as shown by figure 36.



TIMING FUEL INJECTORS:

1. POSITION THE GOVERNOR CONTROL LEVER IN THE STOP POSITION.
2. TURN THE ENGINE CRANKSHAFT UNTIL THE EXHAUST. VALVE FOR THE PARTICULAR CYLINDER TO BE TIMED IS FULLY DEPRESSED.
3. POSITION THE INJECTOR TIMING GAGE IN THE HOLE IN THE TOP OF THE INJECTCR BODY.
4. LOOSEN THE FUEL INJECTOR PUSH ROD LOCK NUT.
5. TURN THE PUSH ROD AND ADJUST THE INJECTOR-ROCKER ARM UNTIL THE EXTENDED PART OF THE GAGE WILL JUST PASS OVER THE TOP OF THE INJECTOR LIFTER GUIDE.
6. HOLD PUSH ROD AND TIGHTEN LOCK NUT,
7. CHECK THE ADJUSTMENT AND READJUST IF NECESSARY.
8. ADJUST TIHE REMAINING FUEL INJECTORS.

EMC 6115-293-35/36

Figure 36. Timing fuel injectors.

h. Adjust the exhaust valves (TM 5-6115-293-12).

Section XI. CYLINDER HEAD, ROCKER ARM, AND VALVES

74. General

The cylinder head is a one-piece casting which can be removed from the engine block as an assembly containing cam followers, guides, rocker arms, and valves. The cylinder head is held securely to the cylinder block by studs, nuts, and bolts. Located in the cylinder head are 2 exhaust valves, a fuel injector, and 3 rocker arms for each cylinder. The exhaust valve seat inserts are shrunk into the cylinder head. These inserts furnish accurate seating of the valves under varying conditions of temperature and materially prolong the life of the cylinder head. They are ground to close limits and their freedom from warpage, under ordinary conditions, reduces valve conditioning to a minimum.

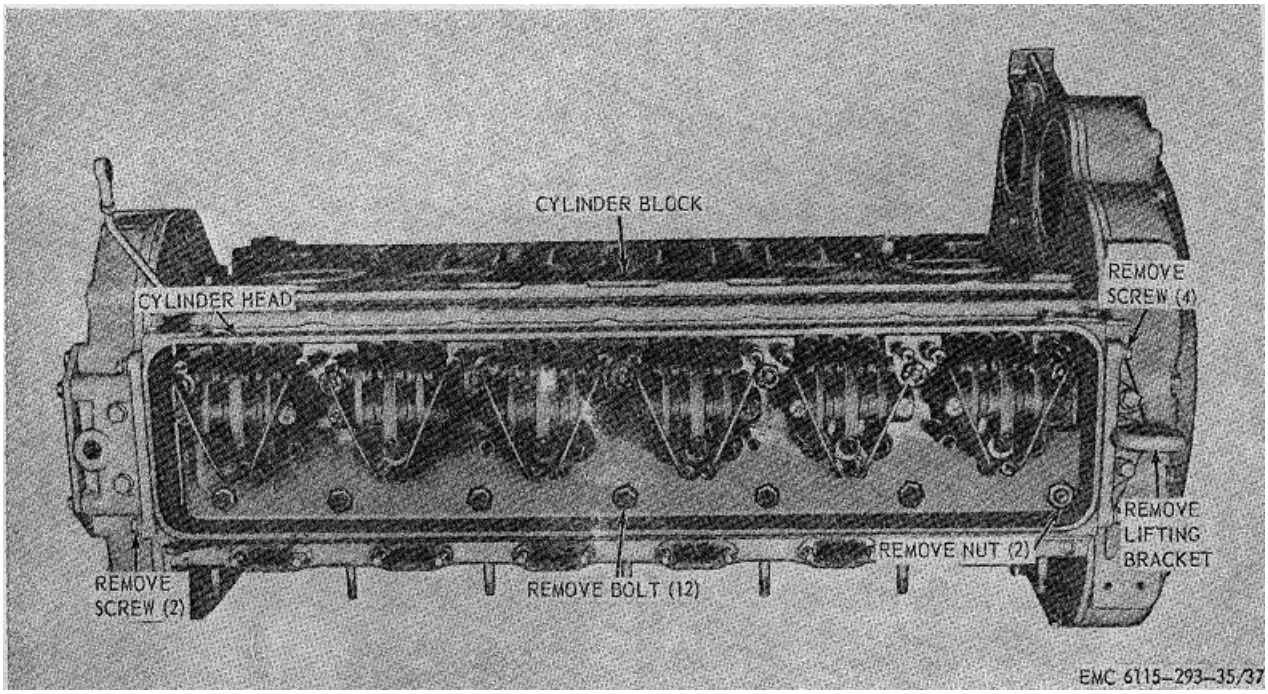


Figure 37. Cylinder head, removal and installation.

75. Cylinder Head

a. Remove and install the outlet water manifold (TM 5-6115-293-12).

b. Remove and install the lifting frame (par. 44)

c. Remove and install the governor (par. 81).

d. Remove and install the fuel control tube and lever (TM 5-6115-293-12).

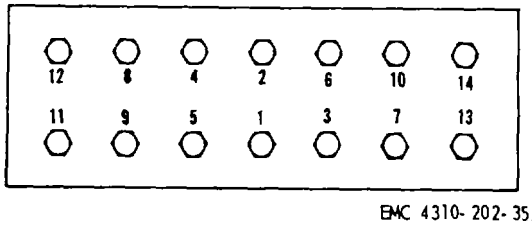


Figure 38. Cylinder head nut and bolt tightening sequence.

e. Remove and install the cylinder head as shown by figure 37.

f. Tighten the nuts and bolts as shown by figure 38.

g. Remove and install the rocker arms (par. 76).

h. Remove and install the fuel injectors (par. 73).

i. Remove and install the valves and valve seat inserts (par. 77).

76. Rocker Arms

a. Remove and install the rocker arm cover (TM 5-6115-293-12).

b. Remove and install the rocker arms and valves as shown by figure 39.

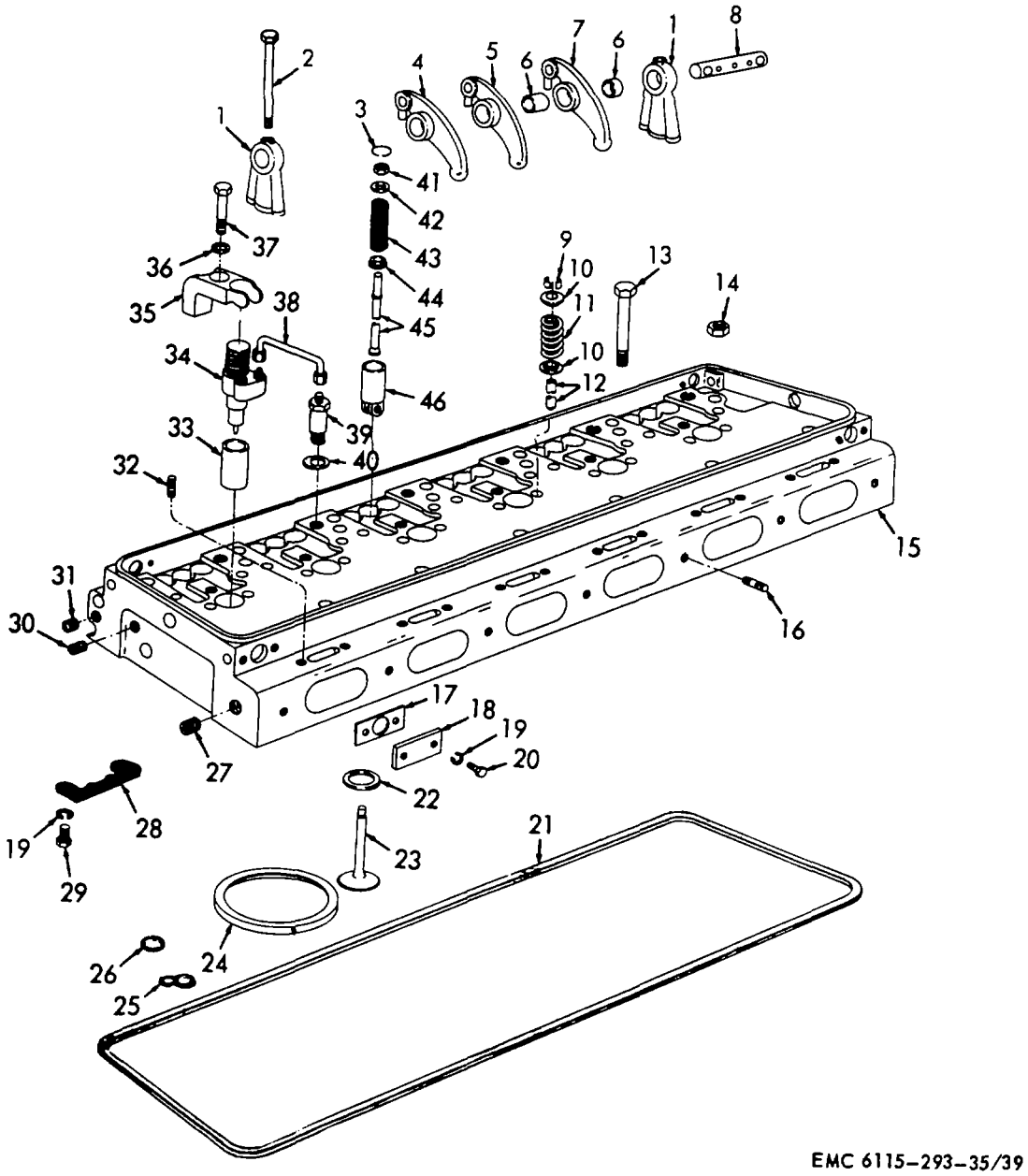


Figure 39. Rocker arms and valves, disassembly and reassembly.

1 Rocker shaft bracket (12 rqr)
2 Bolt, hex-hd, ½-13 x 4¼ in. (12 rqr)
3 Push rod snapring (18 rqr)
4 Rocker arm, left (6 rqr)
5 Injector rocker arm (6 rqr)
6 Bushing (18 rqr)
7 Rocker arm, right (6 rqr)
8 Rocker arm shaft (6 rqr)
9 Valve lock (24 rqr)
10 Exhaust valve spring seat (24 rqr)
11 Exhaust valve spring (12 rqr)
12 Valve guide
13 Bolt, hex-hd, 5/8-11 x 5½ in. (12 rqr)
14 Nut, plain, hex, 9/16-18 (12 rqr)
15 Cylinder head
16 Stud, 7/16-14 x 2 in. (7 rqr)
17 Gasket (2 rqr)
18 Governor hole cover (2 rqr)
19 Washer, lock, ¼ in. (18 rqr)
20 Screw, cap, ¼-20 x ½ in. (6 rqr)
21 Cylinder head gasket
22 Valve seat insert (12 rqr)
23 Exhaust valve (12 rqr)
24 Cylinder head gasket (6 rqr)
25 Rubber gasket (2 rqr)
26 Fiber gasket (4 rqr)
27 Plug, pipe, 7/16-14 (4 rqr)
28 Cam follower guide (6 rqr)
29 Bolt, hex-hd, ¼-20 x ¾ in. (12 rqr)
30 Plug, pipe, ¼-20 (18 rqr)
31 Plug, pipe, ¾-10 (4 rqr)
32 Stud, 3/8-16 x 1¾ in. (12 rqr)
33 Injector hole tube (6 rqr)
34 Injector (6 rqr)
35 Injector clamp (6 rqr)
36 Washer, flat, 5/16 in. (6 rqr)
37 Bolt, hex-hd, 5/16-18 x 2 in. (6 rqr)
38 Fuel line (12 rqr)
39 Fuel adapter (6 rqr)
40 Flat washer (spec) (6 rqr)
41 Push rod locknut
42 Upper spring seat (18 rqr)
43 Push rod spring (18 rqr)
44 Lower spring seat (18 rqr)
45 Push rod (18 rqr)
46 Cam follower assembly (18 rqr)

Figure 39-Continued.

c. Clean, inspect, and repair.

77. Valves, Valve Seat Inserts, and Valve Guides

a. Cylinder compression pressure is tested as follows:

(1) Remove and install the rocker arm cover (TM 5-6115-293-12).

(2) Remove and install the injector from the No. 1 cylinder (par. 73).

(3) Temporarily install a compression gage and adapter in the same manner as an injector.

(4) Use one of the fuel lines, removed in (2) above, as fuel return between the fuel inlet and the return manifold connector.

(5) Start the engine and run it at approximately 625 rpm; note the compression gage reading.

(6) Repeat the procedure on the five remaining cylinders. The compression gage should indicate not less than 400 psi. There must not be more than 25 psi variation between the cylinders.

b. Remove and install the cylinder head (par. 75).

c. Remove the valves, valve seat inserts, and valve guides as shown by figure 39.

Note. Remove only the valve guides and valve seat inserts which inspection reveals to be unsatisfactory for further use.

d. Clean, inspect, and repair.

e. Reface the valve and grind the valve seat inserts as follows:

(1) Using a valve face grinder, reface the valve to an angle of 30°.

(2) Install a pilot of correct size in the valve stem bore of the valve guide. Face the stone on the valve reseating outfit to an angle of 30°. Place the grinder and stone assembly over the pilot in the valve stem bore of the valve guide and grind just enough to make a smooth seat.

(3) Inspect the valve seats for concentricity with a dial indicator.

f. Install the valves, valve seat inserts, and valve guides as shown by figure 39.

g. Adjust the rocker arm (TM 5-6115-293-12).

Section XII. ENGINE OVERSPEED-GOVERNOR

78. General

When the diesel engine speeds exceed the setting of the engine overspeed governor, two flyweights in the governor, spinning at high speed, move outward, forcing a plunger against the operating buttons of the microswitches. The switches close circuits of the engine emergency shutdown system to stop the engine.

79. Engine Overspeed Governor

a. Remove and install the firewall plate as shown by A, figure 31

b. Remove and install the engine overspeed governor as shown by figure 40.

c. Disassemble and reassemble the engine overspeed governor as shown by figure 41.

d. Clean, inspect, and repair.

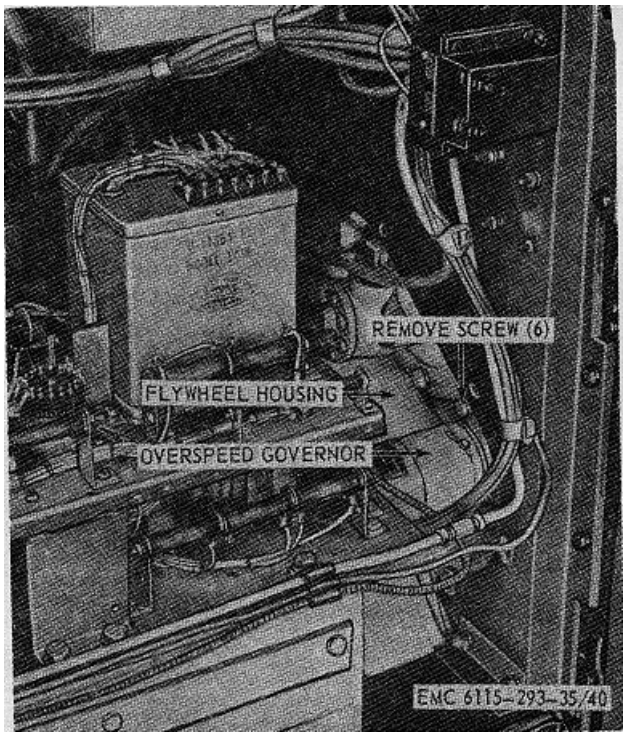
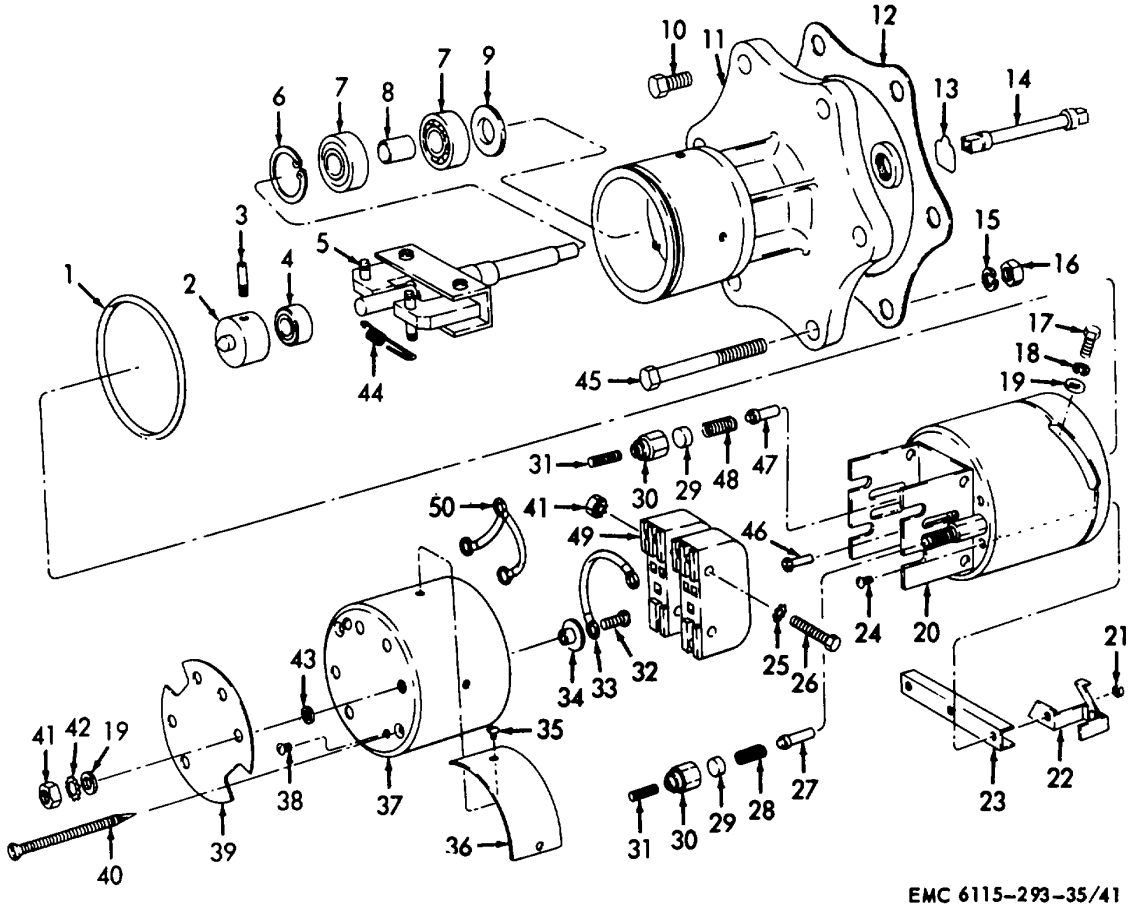


Figure 40. Engine overspeed governor, removal and installation.



1 Preformed packing
2 Switch actuator
8 Setscrew (spec)
4 Bearing
5 Weight and shaft
6 Retaining ring
7 Bearing (2 rqr)
8 Bearing spacer
9 Plain encased seal (2 rqr)
10 Screw, cap, hex-hd, 3/18 -16 x 7/8 in. (2 rqr)
11 Body
12 Gasket
13 Retaining clip
14 Governor control shaft
15 Washer, lock, 3/8 in. (4 rqr)
16 Nut, plain, hex, 3/8 x 24 (4 rqr)
17 Screw, cap, hex-hd, No. 8-32 x 3/8 in. (3 rqr)
18 Washer, lock, No. 8 (3 rqr)
19 Washer, flat, No. 8 (8 rqr)
20 Governor cap
21 Nut, plain, hex, No. 6-32 (2 rqr)
22 Flat spring (2 rqr)
23 Channel lever
24 Screw, machine, No. 6-32 x 5/16 in. (2 rqr)
25 Washer, lock, ET, No. 8 (4 rqr)
26 Screw, cap, hex-hd, No. 8-32 x 1 3/8 in. (2 rqr)
27 Spring pin (2 rqr)
28 Low-speed adjusting spring
29 Spring cap (2 rqr)
30 Nut (spec) (2 rqr)
81 Setscrew (spec) (2 rqr)
32 Screw, machine, No. 8-32 x 3/4 in. (6 rqr)
83 Electrical lead
34 Terminal bushing (5 rqr)
35 Screw, thd-forming, No. 2 x 1/4 in. (2 rqr)
36 Nameplate
87 Dust cover
38 Screw, machine, No. 6-32 x 1/8 in. (2 rqr)
39 Insulating washer (spec)
40 Screw, machine, flat-hd, No. 8-32 x 2 in. (2 rqr)
41 Nut, plain, hex No. 8-32 (5 rqr)
42 Washer, lock, ET, No. 8 (5 rqr)
43 Insulating washer (spec) (5 rqr)
44 Flyweight spring (2 rqr)
45 Screw, cap, hex-hd, 3/8-24 x 5 1/4 in. (4 rqr)
46 Switch lifter
47 Switch lifter
48 High-speed adjusting spring
49 Switch (2 rqr)
50 Electrical lead

Figure 41. Engine overspeed governor, disassembly and reassembly.

Section XIII. GOVERNOR AND GOVERNOR DRIVE

80. General

The engine speed governor is an isochronous, hydraulic, speed and load-sensing governor with adjustable speed droop. The governor takes its oil supply from the engine. The governor is single acting; that is, it utilizes oil pressure in one direction only and depends on the spring force to move the fuel control linkage to the fuel off position. The governor oil, under pressure, is carried through passages to the two pilot valves; one of which is a part of the speed section and the other a part of the load section. These are three-way spool valves, arranged to connect the areas below their respective servo pistons to pressure oil or to sump, depending on whether the individual pilot valve plunger has been raised or lowered from center. The governor flyweights are carried on pivot pins in the rotating bushings which form the outer member of the valve and the drive shaft in the speed-sensing portion of the governor. The flyweights act upon a thrust bearing attached to the pilot valve plunger, and their centrifugal force is changed to axial force at the flyweight toes and is opposed by the speeder springs. Speeder spring compression, and therefore the speed at which the governor must run in order that the flyweight force will balance that of the spring, is adjusted by the position of the speed adjusting lever. The load sensing pilot valve plunger is actuated by a force motor which assumes a vertical position proportion to the load signal it receives from the computer. The governor includes a 115-volt, ac electric motor of reversible type which is used to manually adjust engine speed. The governor drive is a right-angle drive which receives power from the upper blower rotor and transmits it to the governor.

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81. Governor

a. Remove and install the governor as shown by figure 42.

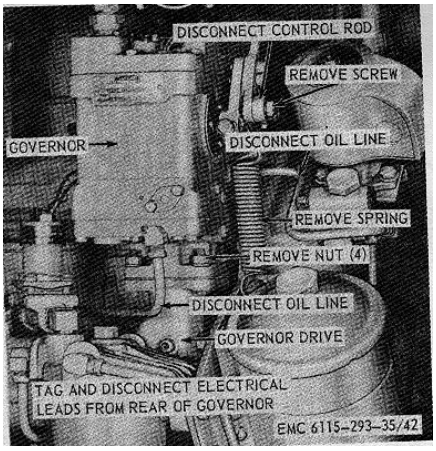


Figure 42. Governor, removal and installation.

b. Disassemble and reassemble the governor as shown by figure 43.

c. Adjust the governor speed droop as shown by figure 44.

82. Governor Drive Assembly

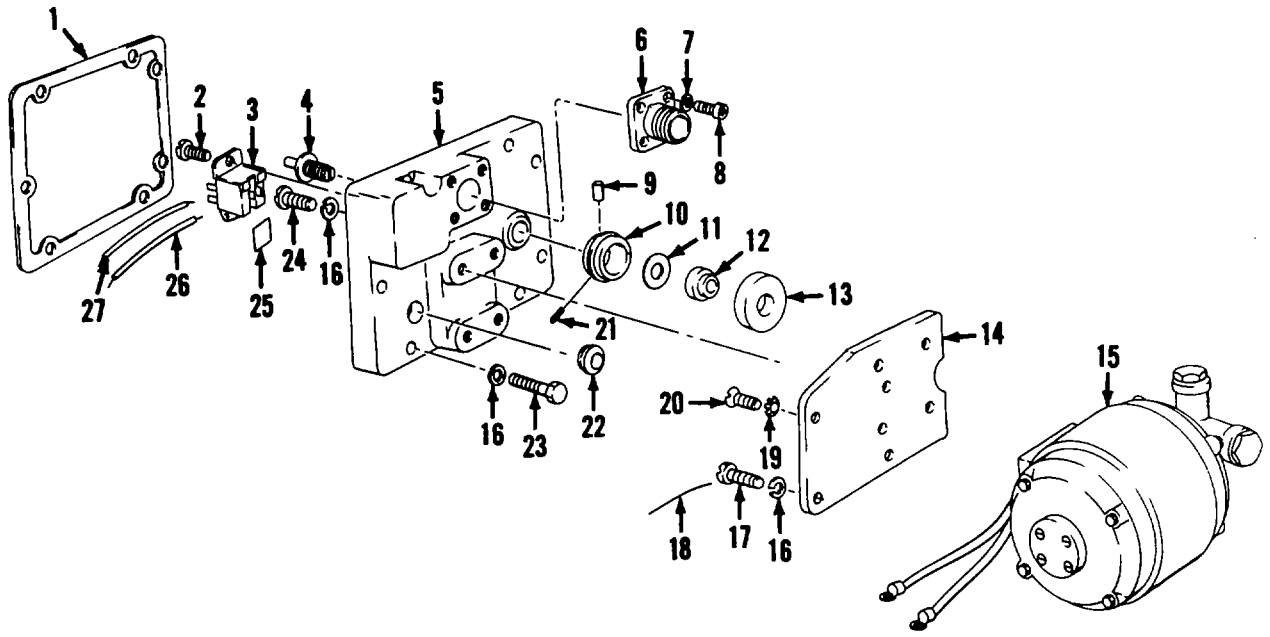
a. Remove and install the governor (par. 81).

b. Remove and install the governor drive as shown by figure 45.

c. Disassemble and reassemble the governor drive as shown by figure 46.

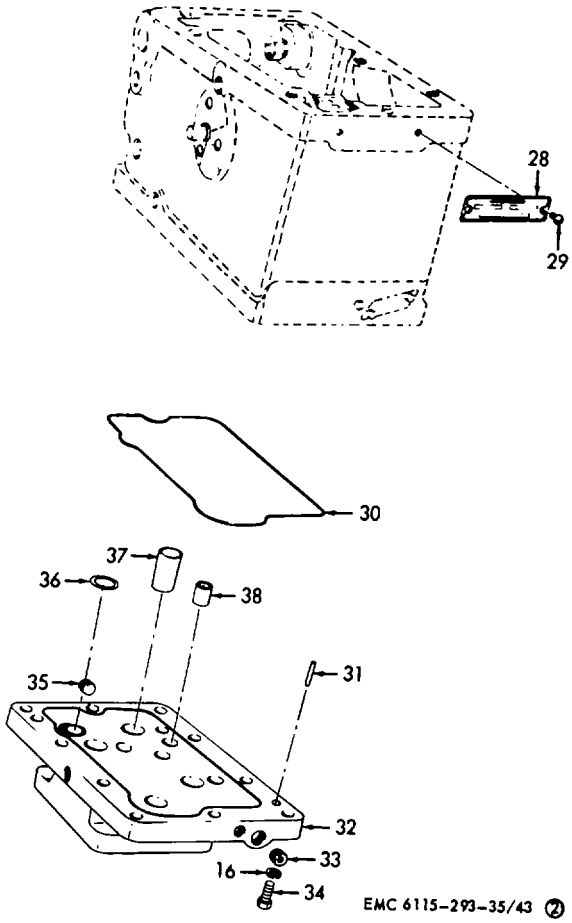
d. Clean, inspect, and repair

.



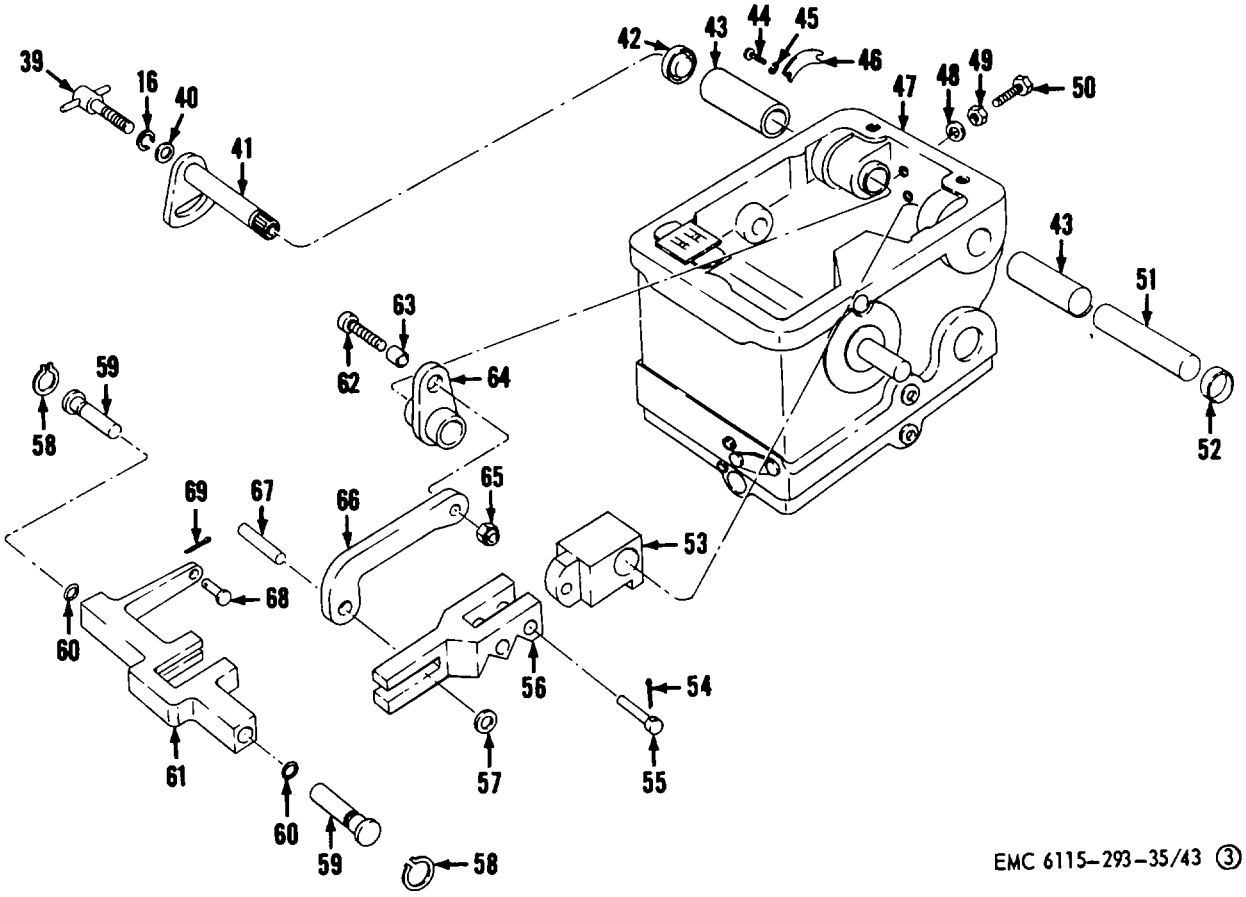
1 Gasket
2 Screw, machine, truss-hd, No. 6-32 x 3/8 in. (2 rqr)
3 Plug (spec)
4 Adjusting screw (spec)
5 Cover
6 Connector
7 Washer, lock, No. 6 (4 rqr)
8 Screw, machine, fil-hd, No. 6-32 x 7/16 in. (4 rqr)
9 Roll pin (spec)
10 Friction disk seat
11 Spring washer
12 Friction disk
13 Friction disk cover
14 Motor bracket
15 Motor
16 Washer, lock, No. 10 (21 rqr)
17 Screw, machine, drilled-hd, No. 10-32 x 1/2 in. (2 rqr)
18 Lockwire (2 rqr)
19 Washer, lock, ET, No. 10 (2 rqr)
20 Screw, machine, flat-hd, No. 10-32 x 1/2 in. (2 rqr)
21 Setscrew, internal-wrenching, No. 6-32 x 1/4 in.
22 Grommet
23 Screw, machine, hex-hd, No. 10-32 x 1 in. (7 rqr)
24 Screw, machine, fil-hd, No. 10-32 x 3/4 in. (4 rqr)
25 Insulating strip
26 Electrical lead
27 Electrical lead

Figure 43. Governor, disassembly and reassembly.



28 Nameplate
29 Drive screw (2 rqr)
30 Oil seal ring
31 Dowel pin (2 rqr)
32 Base
33 Plug, pipe, socket-hd, 1/8-27
34 Screw, cap, hex-hd, No. 10-32 7/8 - in. (10 rqr)
35 Plug, pipe, socket-hd, nonmagnetic, 1/16 -27 (3 rqr)
36 O-ring
37 Bushing
38 Check valve (2 rqr)

Figure 43. Governor, disassembly and reassembly-Continued.



39	Speed droop lock screw	55	Speed adjusting lever pivot pin
40	Washer, flat, No. 10 (3 rqr)	56	Floating lever
41	Speed droop quadrant shaft	57	Washer (spec)
42	Oil seal	58	Retaining ring (2 rqr)
43	Bushing (2 rqr)	59	Speed droop lever pivot pin (2 rqr)
44	Screw, machine, rd-hd, No. 4-40 x 1/4 in. (2 rqr)	60	O-ring (2 rqr)
45	Washer, lock, No. 4 (2 rqr)	61	Speed droop lever
46	Droop indicator plate	62	Screw, cap, socket-hd, No. 10-32 x 5/8 in. (2 rqr)
47	Body	63	Bushing
48	Washer, flat, copper, No. 10 (2 rqr)	64	Speed droop bellcrank
49	Stop nut (spec) (2 rqr)	65	Nut, stop, elastic, No. 10-32
50	Screw, machine, hex-hd, No. 10-32 x 1 in. (2 rqr)	66	Speed droop link
51	Speed adjusting shaft	67	Speed droop pivot pin
52	Tapered plug	68	Speed droop lever pin
53	Speed adjusting lever	69	Pin, cotter, 1/16 x , 9/16 in.
54	Pin, cotter, 1/16 x 7/8 in. (3 rqr)		

Figure 43. Governor, disassembly and reassembly-Continued.

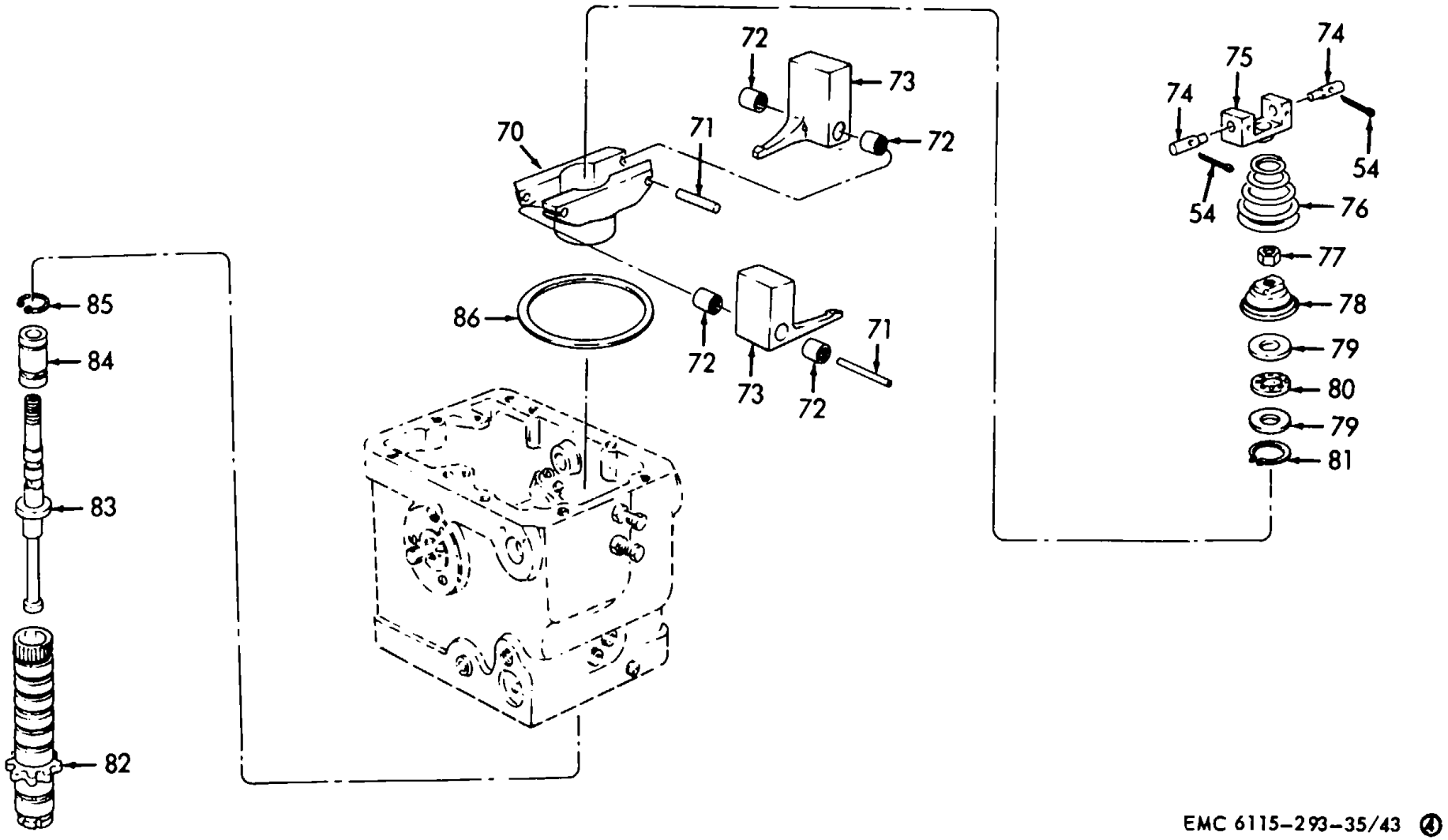


Figure 43. Governor, disassembly and reassembly-Continued.

70 Ball head
71 Ball arm pin (2 rqr)
72 Needle bearing (4 rqr)
73 Ball arm (2 rqr)
74 Floating lever pivot pin (2 rqr)
75 Spring fork
76 Speeder spring
77 Pivot valve plunger nut (spec)
78 Spring seat
79 Bearing race (2 rqr)
80 Bearing
81 Snapring
82 Pilot valve bushing
83 Pilot valve
84 Pilot valve compensating bushing
85 Retaining ring
86 Spirolox ring

Figure 43-Continued.

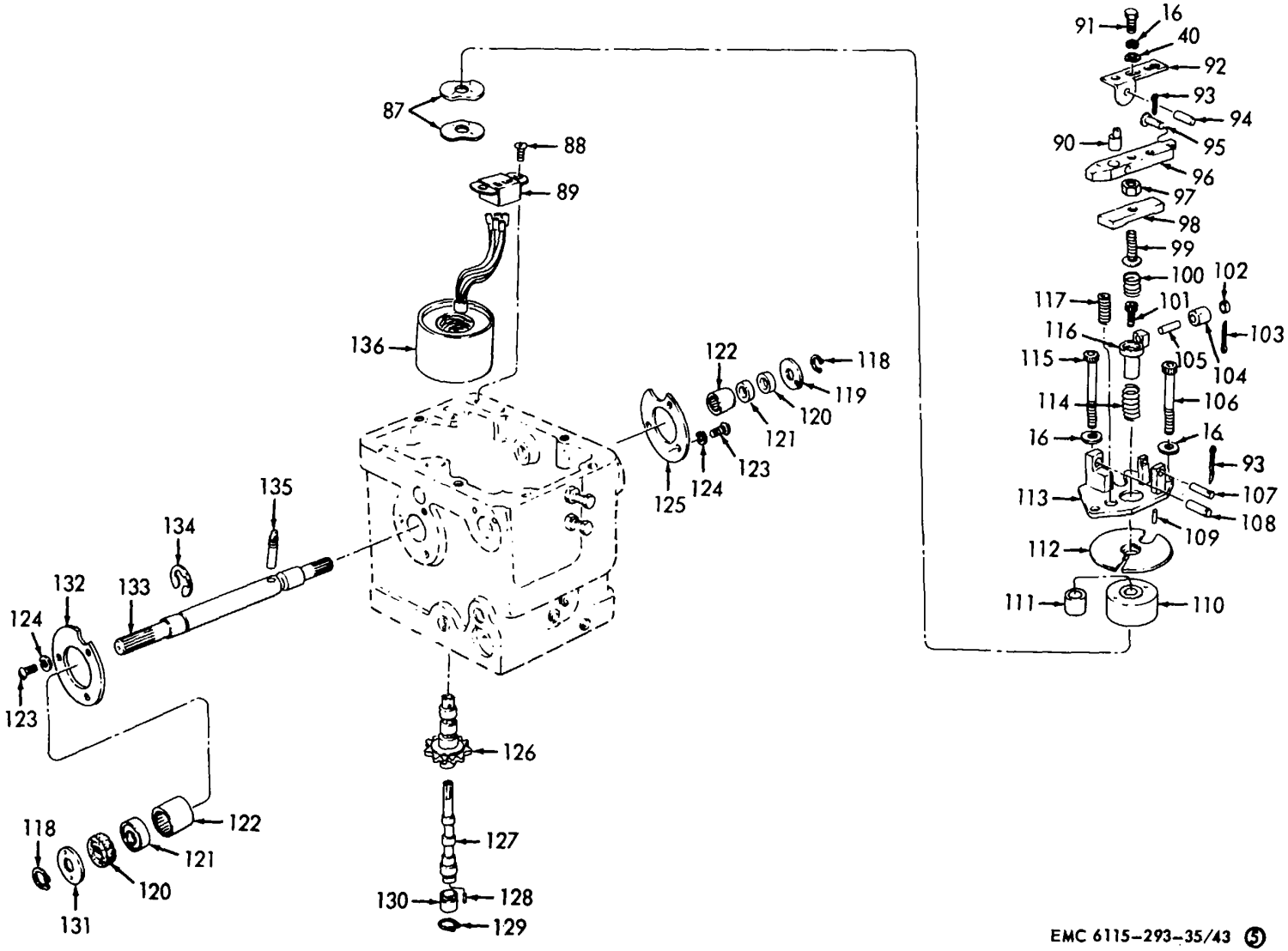
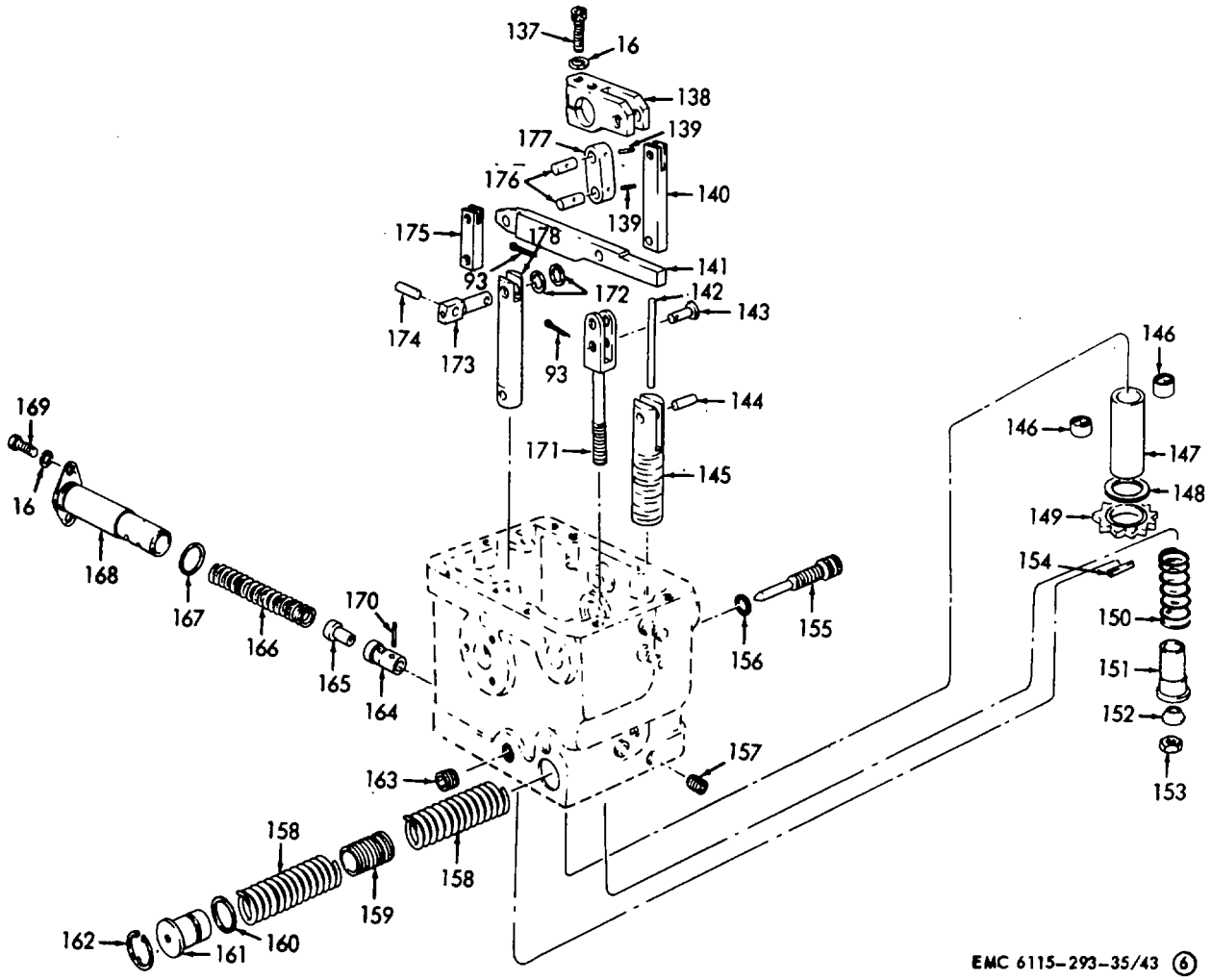


Figure 43. Governor, disassembly and reassembly-Continued.

87 Spring washer (2 rqr)
88 Screw, machine, No. 6-32 x 3/8 in. (2 rqr)
89 Socket
90 Eccentric pin
91 Screw, cap, hex-hd, No. 10-32 x 1/2 in. (2 rqr)
92 Eccentric clamping plate
93 Pin cotter, 1/16 x 1/2 in. (4 rqr)
94 Eccentric clamping plate pin
95 Restoring lever pin
96 Restoring lever
97 Valve plunger nut (spec)
98 Transducer lever
99 Adjusting spring seat
100 Adjusting spring
101 Screw, socket-hd, nylon, No. 6-32 x 3/8 in.
102 Bearing retaining sleeve
103 Pin, cotter, 1/32 x 3/8 in.
104 Needle bearing
105 Lower spring seat pin
106 Screw, socket-hd, No. 10-32 x 13/4 in.
107 Transducer lever pin
108 Transducer clamp plate pivot pin
109 Pin, roll, 1/16 in. dia x 1/4 in.
110 Magnet
111 Magnet bushing
112 Top coil retainer
113 Transducer clamp bracket
114 Transducer pilot valve support spring
115 Screw, socket-hd, No. 10-32 x 1 7/8 in.
116 Lower spring seat
117 Transducer lever loading spring
118 Retaining ring (2 rqr)
119 Left pointer
120 Felt washer (2 rqr)
121 Oil seal (2 rqr)
122 Needle bearing (2 rqr)
123 Screw, machine, rd-hd, No. 5-40 x 1/4 in(6 rqr)
124 Washer, lock, No. 5 (6 rqr)
125 Left dial plate
126 Load sensing pilot valve gear
127 Load sensing pilot valve
128 Plug (spec)
129 Retaining ring
130 Pilot valve gear sleeve
131 Right pointer
132 Right dial plate
133 Terminal shaft
134 Retaining ring
135 Tapered pin (spec)
136 Retainer body

Figure 43--Continued.



187 Screw, cap, socket-hd, No. 10-32 x 5/8 in.
188 Terminal lever
139 Pin, roll, 0.065 in. dia x 0.367 in. lg (2 rqr)
140 Speed servo link
141 Floating lever
142 Speed servo piston
143 Floating lever pivot pin
144 Speed servo pin
145 Pivot link
146 Valve (2 rqr)
147 Idler gear stud
148 Bushing
149 Idler gear
150 Servo loading piston spring
151 Linkage return piston
152 Pivot
153 Nut, stop, elastic, 1/4-28
154 Pin, roll, 0.160 in. dia x 0.493 in. lg
155 Needle valve
156 O-ring
167 Plug (spec)
158 Buffer piston spring (2 rqr)
159 Buffer piston
160 O-ring
161 Buffer plug
162 Retaining ring
163 Plug (spec)
164 Relief valve bushing
165 Relief valve plunger
166 Relief valve spring
167 O-ring
168 Sleeve
169 Screw, machine, hex-hd, No. 10-32 x 3/8 in. (2 rqr)
170 Relief valve pin
171 Pivot link
172 Washer, lock, 1/4 in. (2 rqr)
173 Load sensing servo pin
174 Load sensing servo link pin
175 Load sensing servo piston link
176 Pivot pin (2 rqr)
177 Floating link
178 Pivot link

Figure 43. Governor, disassembly and reassembly-Continued.

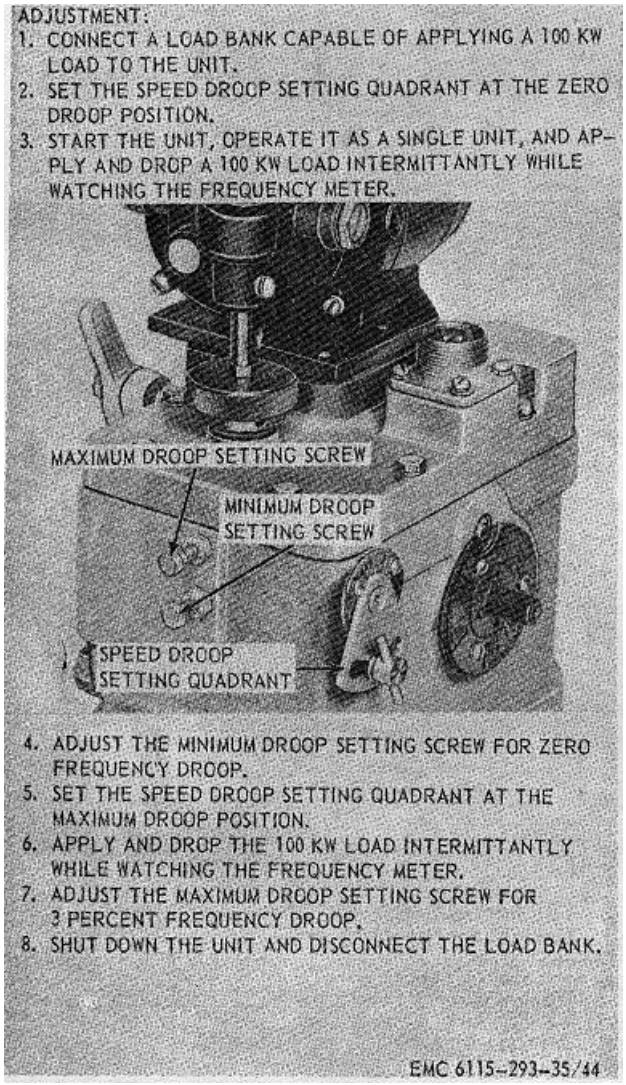


Figure 44. Governor speed droop, adjustment.

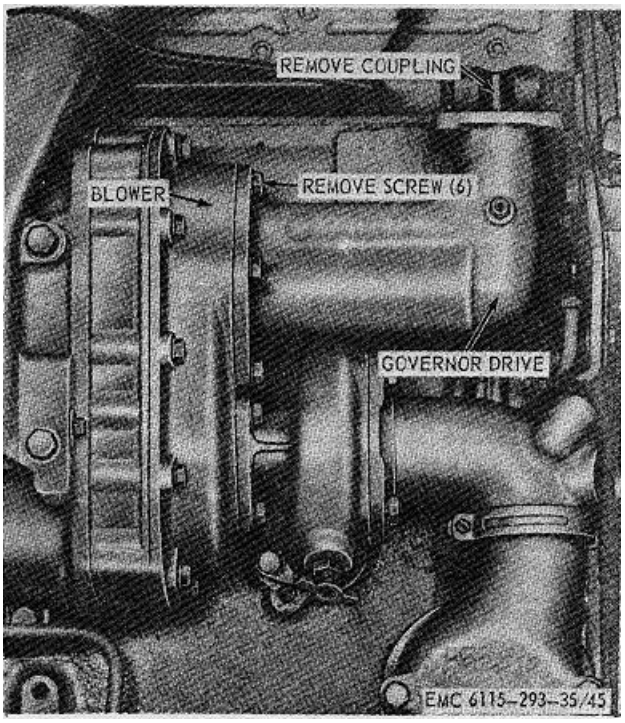
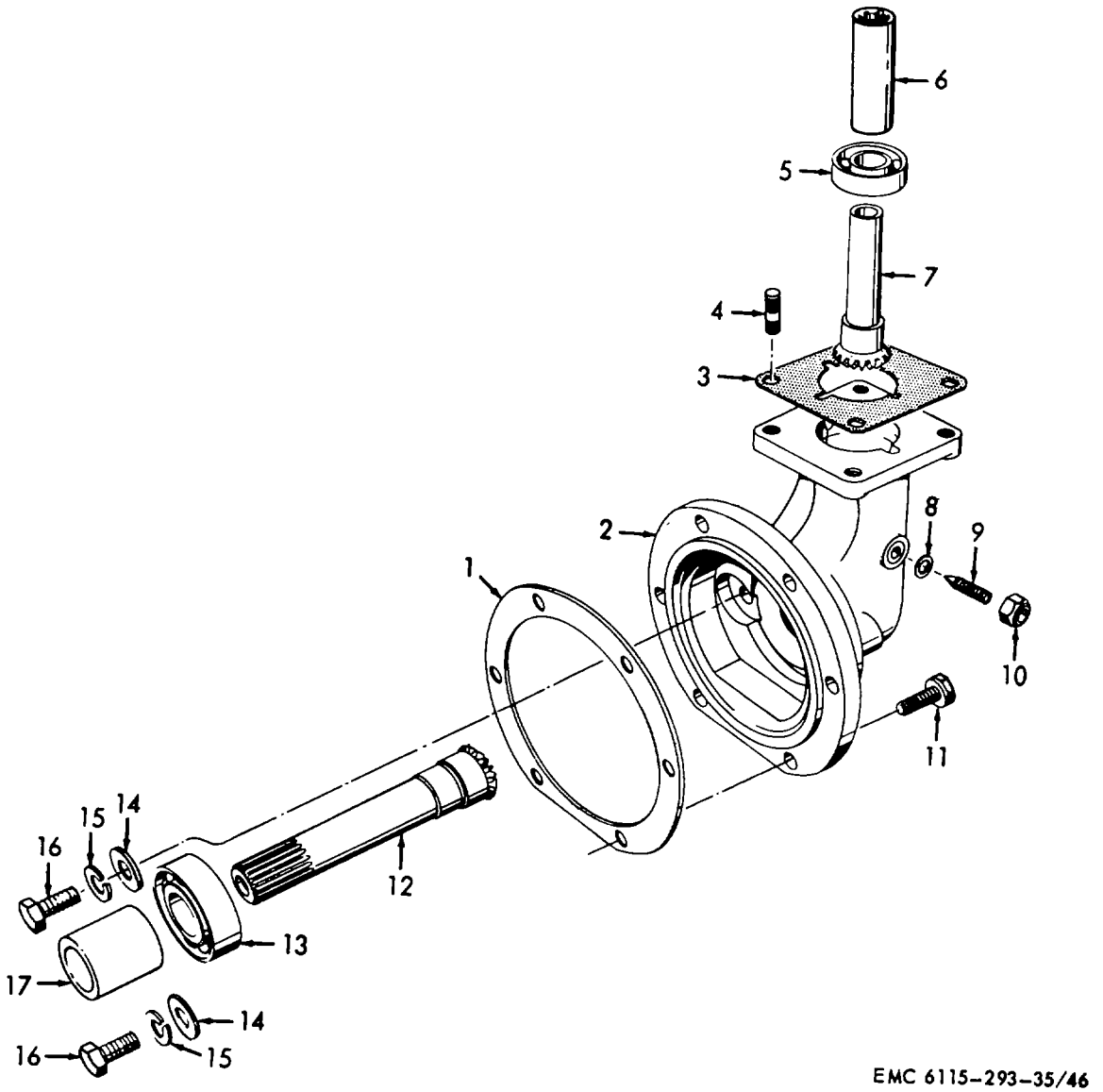


Figure 45. Governor drive, removal and installation.



1	Gasket	10	Nut, hex, self-locking, 1/4-20 (2 rqr)
2	Housing	11	Machine bolt (spec) (6 rqr)
3	Gasket	12	Shaft
4	Stud, plain, 5/16-18 x 5/16-24 x 1 1/2 in. (4 rqr)	13	Annular ball bearing
6	Annular ball bearing	14	Washer, flat, 5/16 in. (2 rqr)
6	Sleeve	15	Washer, lock, 5/16 in. (2 rqr)
7	Gear shaft	16	Bolt, machine, 5/16-18 x 5/8 in. (2 rqr)
8	Washer, flat, 7/16 in. (2 rqr)	17	Spacer
9	Setscrew, allen-hd, 1/4-20 x 1 in. (2 rqr)		

Figure 46. Governor drive, disassembly and reassembly.

Section XIV. CRANKCASE OIL PAN

83. General

The pan, which is shallow, is made of heavy gage steel. It is flanged around the top and is mounted to the bottom of the cylinder block with 34 capscrews. A gasket is mounted between the oil pan and the cylinder block as a seal to prevent the loss of engine oil. The oil pan serves as a housing for the oil pump, internal lubricating lines, and winterization coils. It acts as a reservoir for the engine oil supply. Oil is pumped from the oil pan, circulated throughout the engine, and returned to the oil pan.

84. Crankcase Oil Pan

a. Remove and install the engine (par. 36).

b. Remove and install the crankcase oil pan as shown by figure 47.

c. Disassemble and reassemble the crankcase oil pan as shown by figure 48.

d. Clean, inspect, and repair.

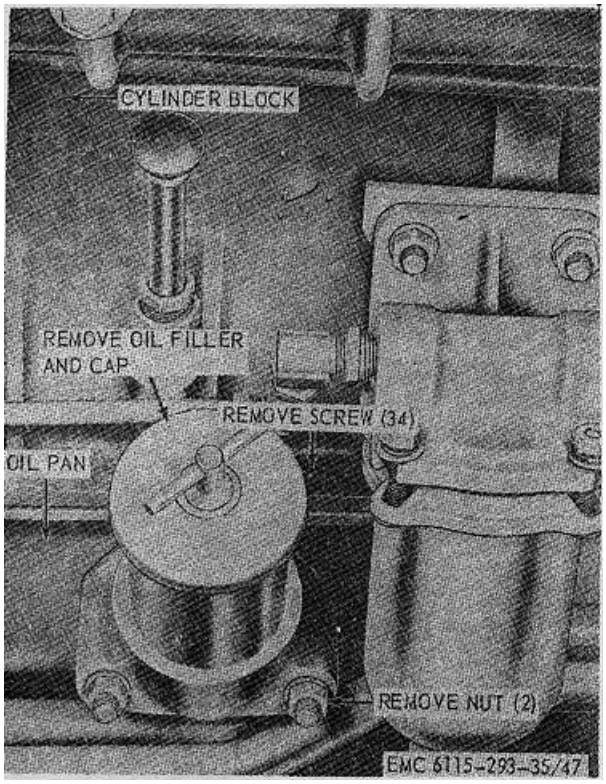
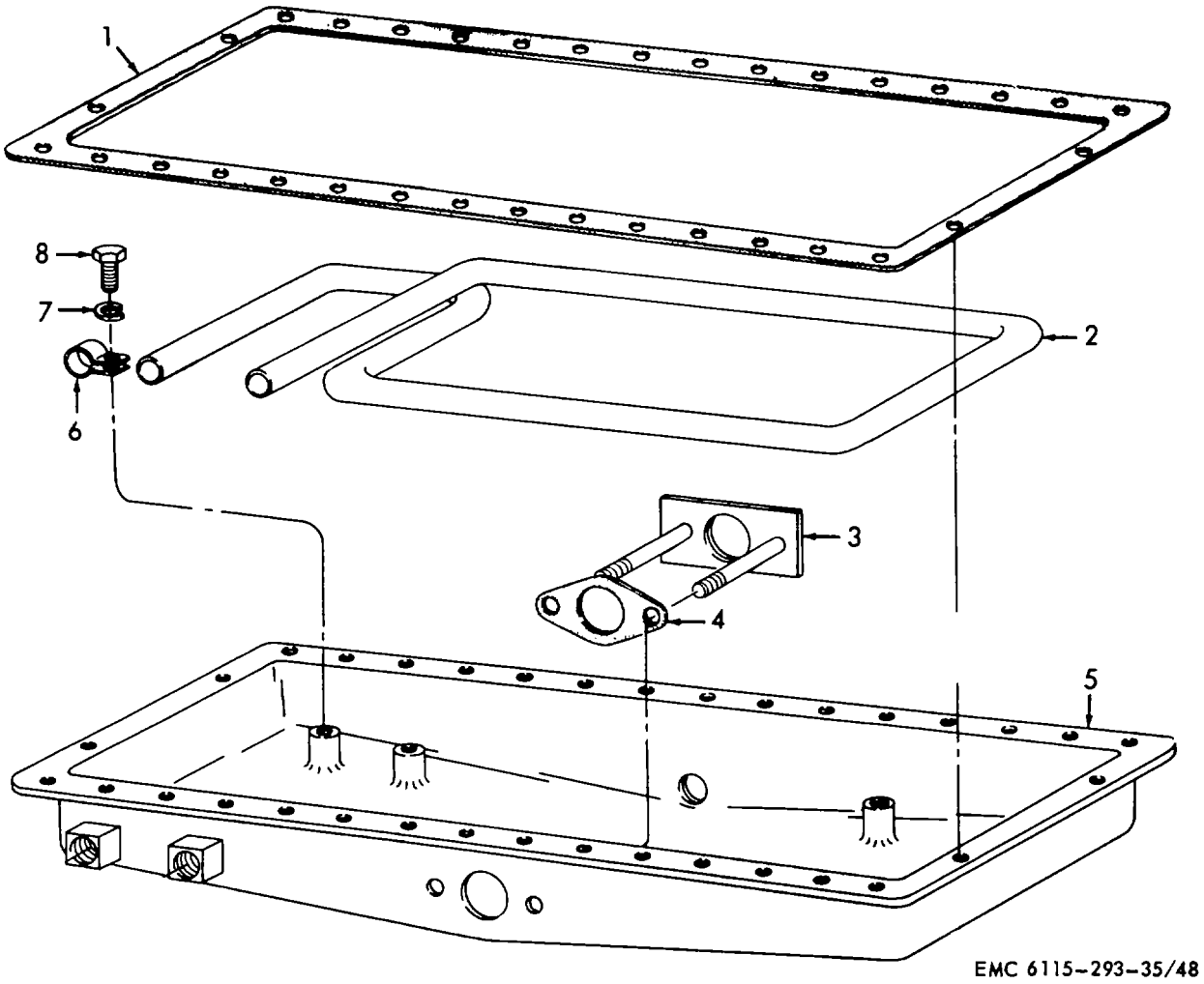


Figure 47. Crankcase oil pan, removal and installation.



1	Gasket	5	Oil pan
2	Heat tube	6	Tube clamp (5 rqr)
3	Plate	7	Washer, lock, 3/8 in. (4 rqr)
4	Gasket	8	Screw, cap, 3/8-24 X 3/4 in. (4 rqr)

Figure 48. Crankcase oil pan, disassembly and reassembly.

Section XV. ENGINE OIL PUMP AND PRESSURE REGULATOR

85. General

The gear-type engine oil pump is mounted on the first and second main bearing caps and is gear driven from the front end of the crankshaft. An internal plunger-type relief valve by-passes the excess oil to the inlet side of the pump when the pressure in the oil lines exceed 100 psi. An inlet pipe, attached to the inlet opening in the pump body, leads to the inlet screen, which is mounted with brackets to a main bearing cap. The inlet screen is located below the oil level in the pan and strains out any foreign material which might damage the pump.

86. Engine Oil Pump and Pressure Regulator

a. Remove and install the crankcase oil pan (par. 84).

b. Remove and install the engine oil pump and pressure regulator as shown by figure 49.

c. Disassemble and reassemble the engine oil pump and oil pressure regulator as shown by figure 50.

d. Clean, inspect, and repair.

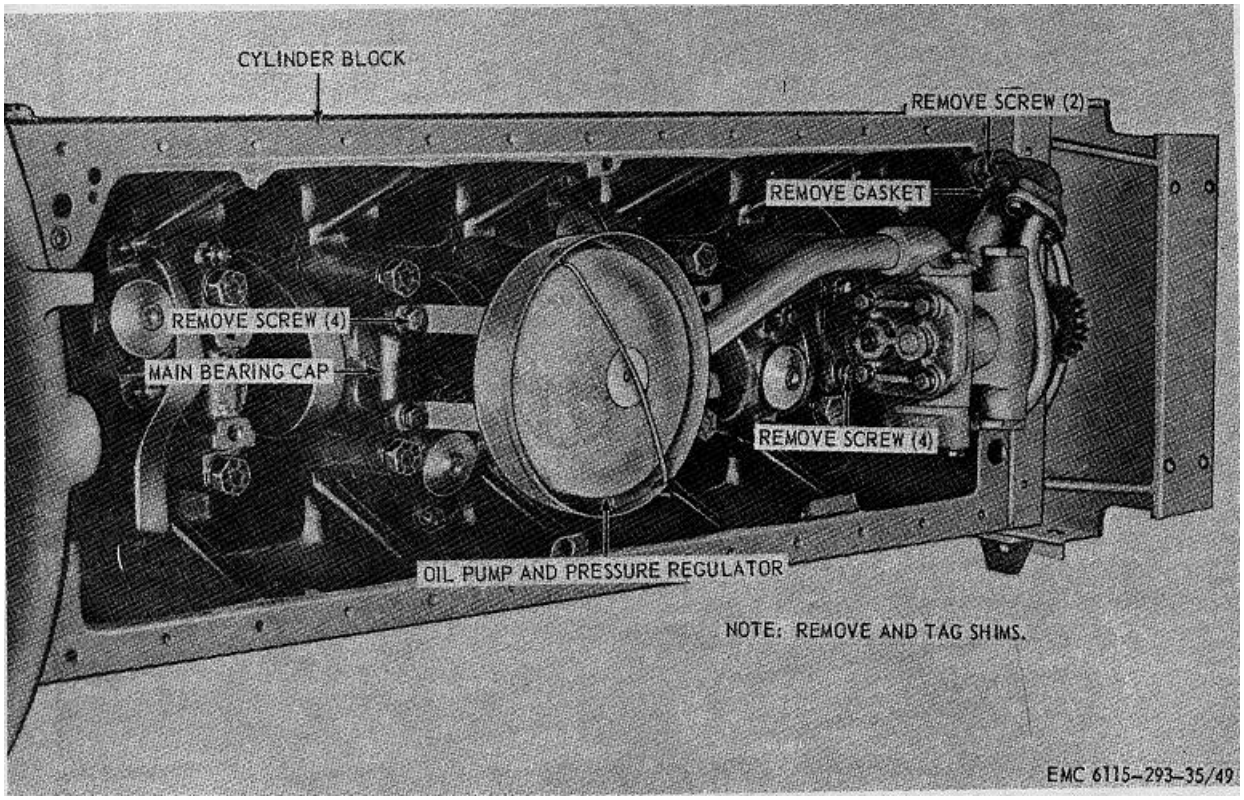


Figure 49. Engine oil pump and pressure regulator, removal and installation.

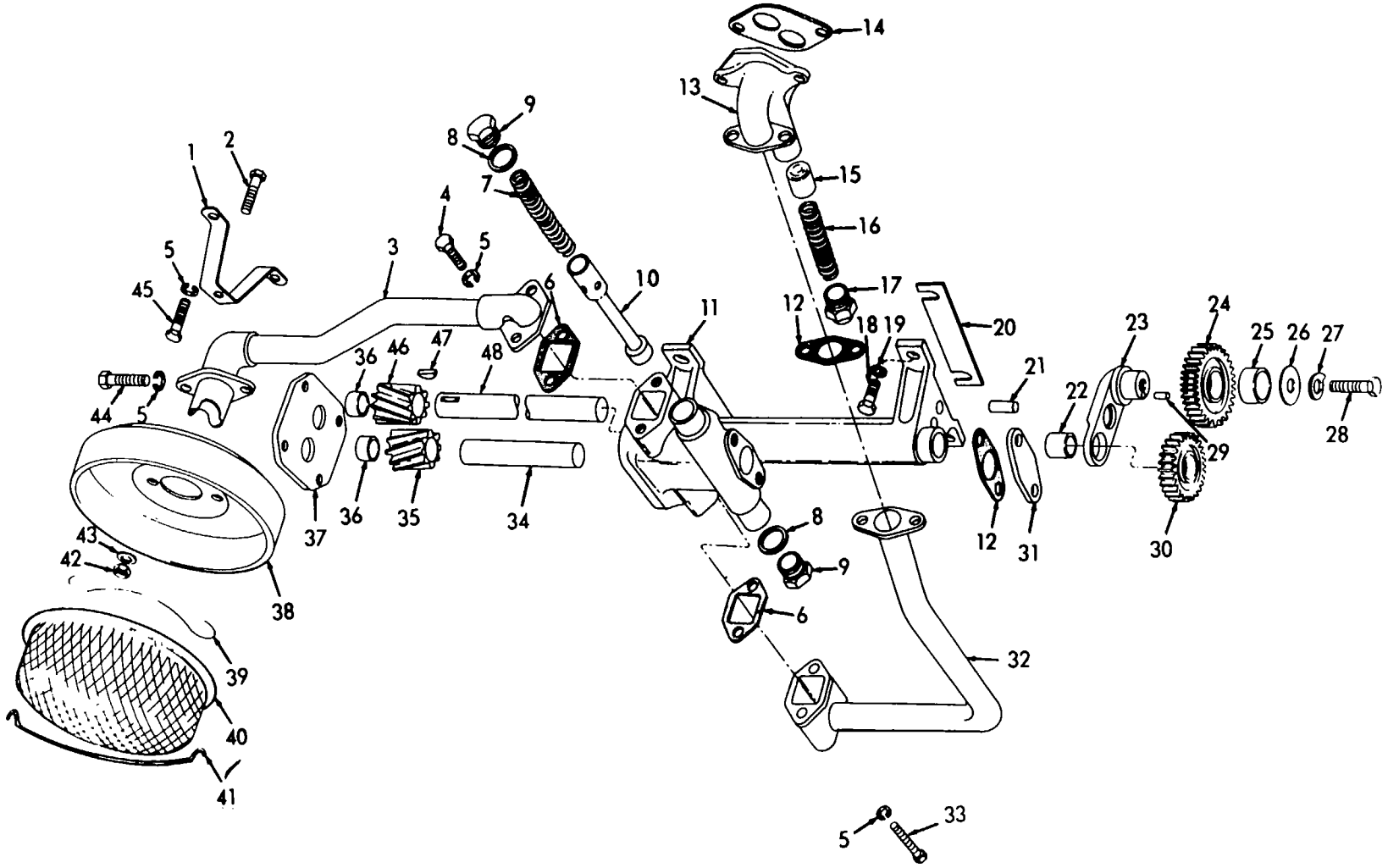


Figure 50. Engine oil pump and oil pressure regulator, disassembly and reassembly.

1 Support bracket (2 rqr)
2 Bolt, hex-hd, 5/16-24 x 1 1/8 in. (6 rqr)
3 Oil pump inlet pipe
4 Screw, cap, 5/16-18 x 1 in. (6 rqr)
5 Washer, lock, 5/16 in. (20 rqr)
6 Gasket (2 rqr)
7 Spring
8 Gasket (2 rqr)
9 Plug, 7/8 in. (2 rqr)
10 Oil pump relief valve
11 Oil pump body
12 Gasket (2 rqr)
13 Oil pressure regulator body
14 Gasket
15 Valve
16 Spring
17 Plug (spec)
18 Screw, cap, 3/8-24 x 1 in. (4 rqr)
19 Washer, lock, 3/8 in. (4 rqr)
20 Shim (as rqr)
21 Locating pin
22 Bushing
28 Oil pump idler gear support
24 Oil pump idler gear
25 Bushing
26 Thrust washer (spec)
27 Washer (spec)
28 Bolt, hex-hd, 3/8-16 x 7/8 in.
29 Dowel
30 Oil pump drive gear
31 Oil pump pad cover
32 Oil pump outlet pipe assembly
33 Bolt, hex-hd, 5/16-18 x 3/4 in. (4 rqr)
34 Driven gear shaft
35 Oil pump driven gear
36 Bushing (2 rqr)
37 Oil pump cover
38 Oil pump inlet screen cover
39 Lockwire
40 Oil pump inlet screen
41 Retainer
42 Nut, castellated, 5/16-24 (2 rqr)
43 Washer, flat, 5/16, in. (2 rqr)
44 Bolt, hex-hd, 516-18 x 1 1/4 in. (4 rqr)
45 Screw, cap, 5/16-24 x 1 in. (4 rqr)
46 Oil pump drive gear
47 Woodruff key (2 rqr)
48 Oil pump drive gear shaft

Figure 50-Continued.

Section XVI. OIL SEPARATOR

87. General

The oil separator is part of the crankcase ventilation system. The oil separator contains steel wool, which restricts the oil but permits crankcase vapors to enter the engine breather pipe and be drawn into the rear air cleaner.

88. Oil Separator

a. Remove and install the engine breather pipe (TM 5-6115-293-12).

b. Remove and install the firewall (par. 40).

c. Remove and install the oil separator as shown by figure 51.

d. Disassemble and reassemble the oil separator as shown by figure 52.

e. Clean, inspect, and repair.

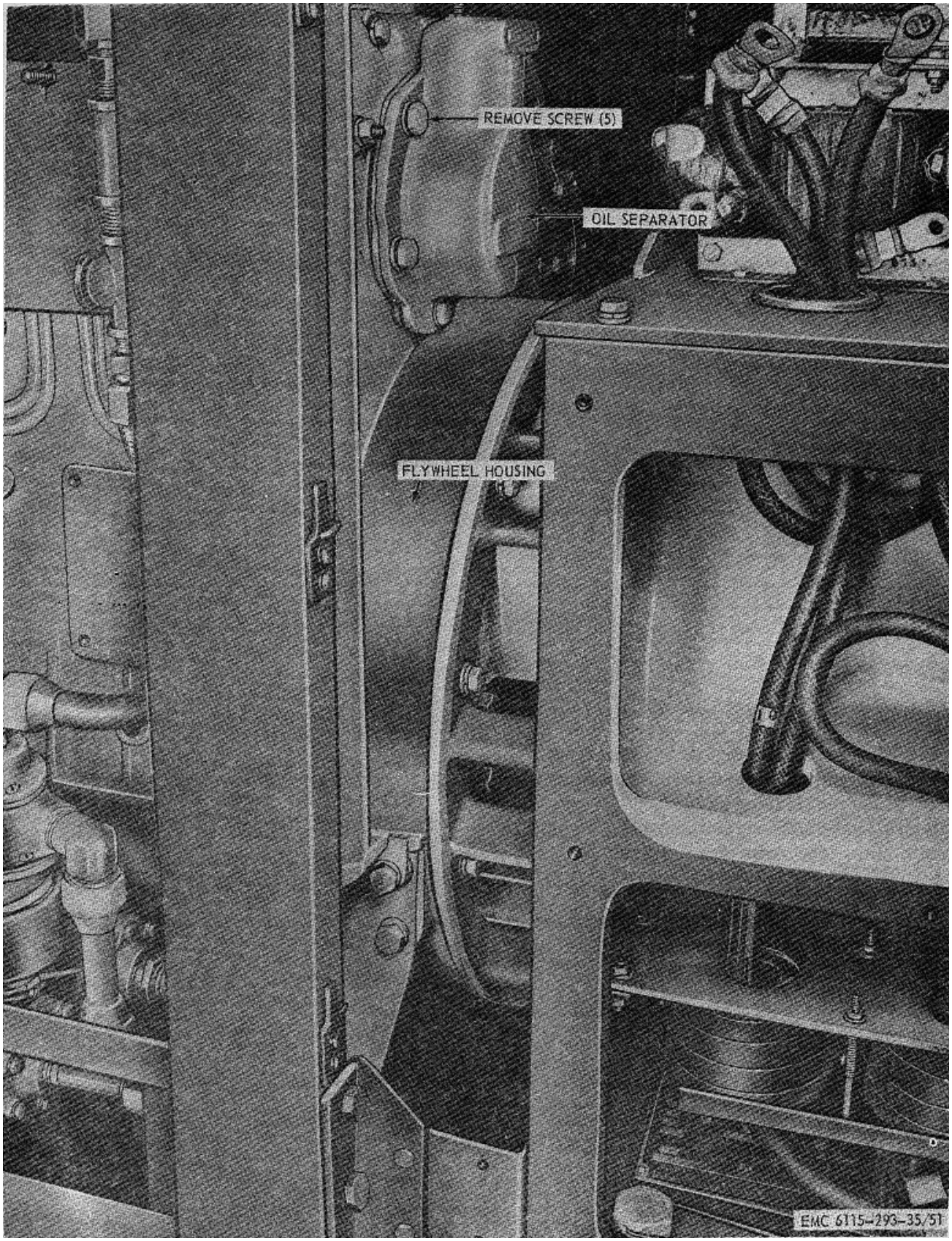
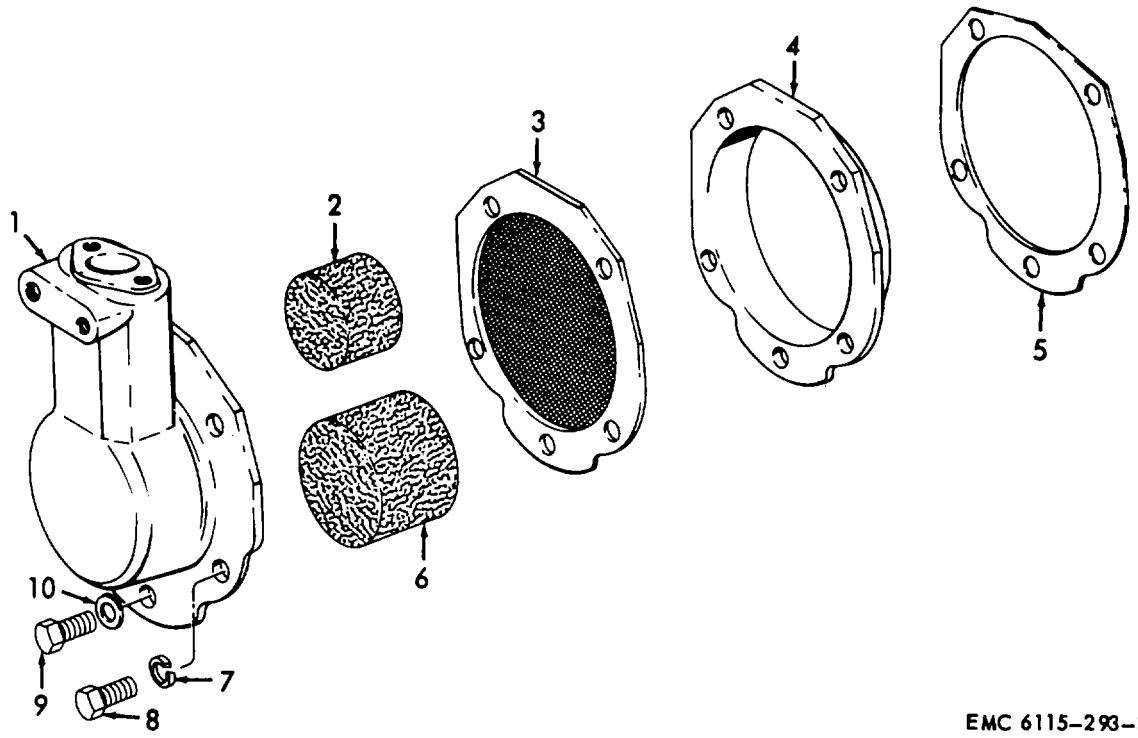


Figure 51. Oil separator, removal and installation.



1 Separator
2 Filter element
3 Gasket
4 Baffle
5 Gasket
6 Filter element
7 Washer, lock, 4 in. (4 rqr)
8 Screw, cap, hex-hd, r13 x 1Y in. (4 rqr)
9 Screw, cap, hex-hd, 7r-14 x 1 in.
10 Washer, flat, copper, 76 in.

Figure 52. Oil separator, disassembly and reassembly.

Section XVII. CRANKSHAFT PULLEY, VIBRATION DAMPERS, UPPER ENGINE SUPPORT, AND FRONT CRANKSHAFT COVER

89. General

The crankshaft pulley is attached to the front end of the engine crankshaft. The pulley, along with the V-belts, is used to drive the engine cooling fan and the battery-charging generator. Two vibration dampers are installed behind the crankshaft pulley to reduce crankshaft vibration. The front of the engine is supported by an upper support which is attached to the front crankshaft cover. The front crankshaft cover contains the front main bearing oil seals.

90. Crankshaft Pulley

a. Remove and install the fan and generator Vbelts (TM 5-6115-293-12).

b. Remove and install the radiator and hood support (par. 39).

c. Remove and install the crankshaft pulley as shown by figure 53.

d. Clean and inspect.

91. Vibration Dampers

a. Remove and install the crankshaft pulley (par. 90).

b. Remove and install the vibration dampers as shown by figure 54.

c. Disassemble and reassemble the vibration dampers and hub as shown by figure 55.

d. Clean, inspect, and repair.

92. Engine Upper Support

a. Remove and install the battery-charging generator (TM 5-6115-293-12).

b. Remove and install the engine (par. 36).

c. Remove and install the vibration dampers (par. 91).

d. Remove and install the engine upper support as shown by figure 56.

e. Clean and inspect.

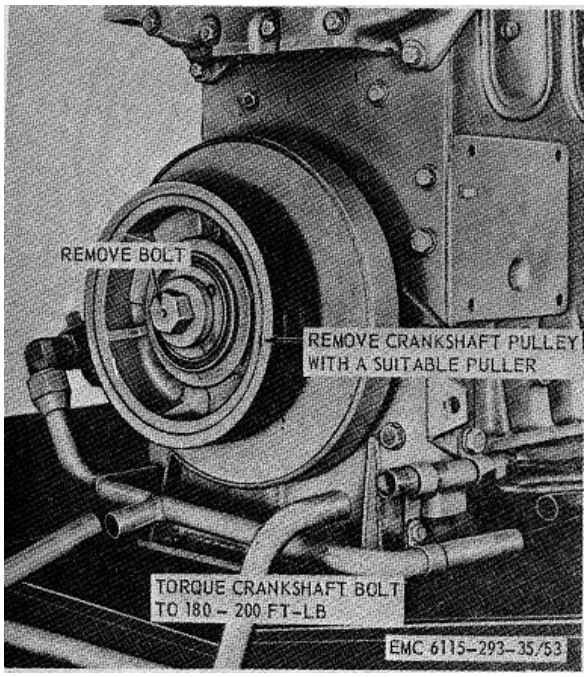


Figure 5s. Crankshaft pulley, removal and installation.

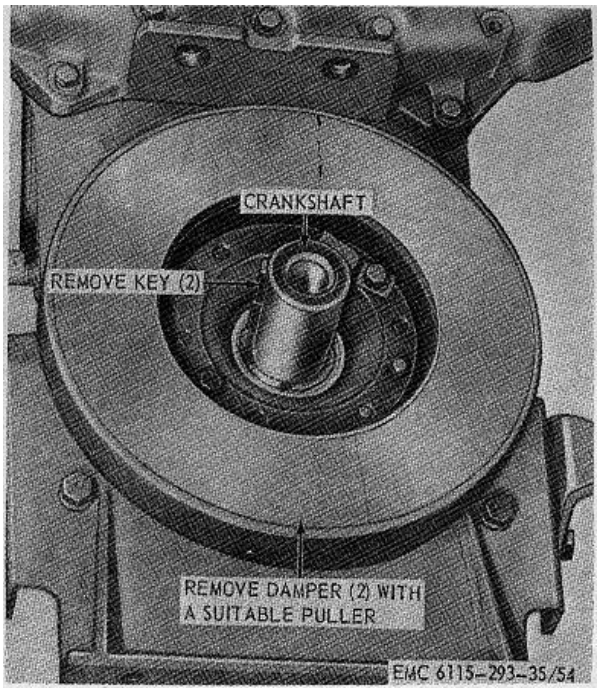
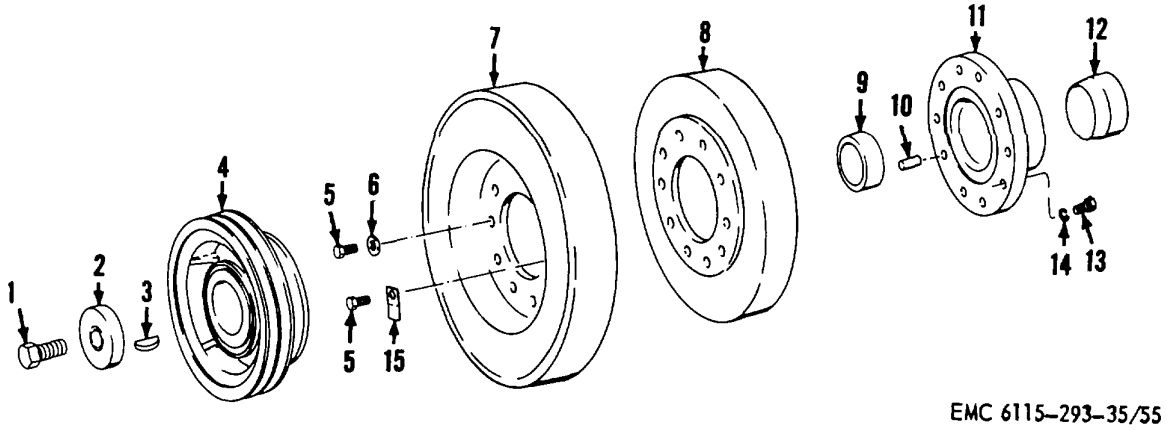


Figure 64. Vibration dampers, removal and installation.



1 Bolt, machine, No. 1-14 x 2jy in.
2 Washer, flat, 1 in.
3 Key, woodruff, No. E (2 rqr)
4 Pulley
5 Screw, cap, hex-hd, Y8/24 x M/ in. (2 rqr)
6 Washer, flat, 8/ in.
7 Vibration damper
8 Light damper
9 Vibration damper cone
10 Dowel (2 rqr)
11 Vibration damper hub
12 Vibration damper cone
13 Screw, cap, hex-hd, 7-20 x 1 in. (6 rqr)
14 Washer, lock, 7f6 in. (6 rqr)
15 Grounding clamp

Figure 55. Vibration damper and hub, disassembly and reassembly.

93. Front Crankshaft Cover

a. Remove and install the engine upper support (par. 92).

b. Remove and install the front crankshaft cover as shown by figure 56.

c. Clean and inspect.

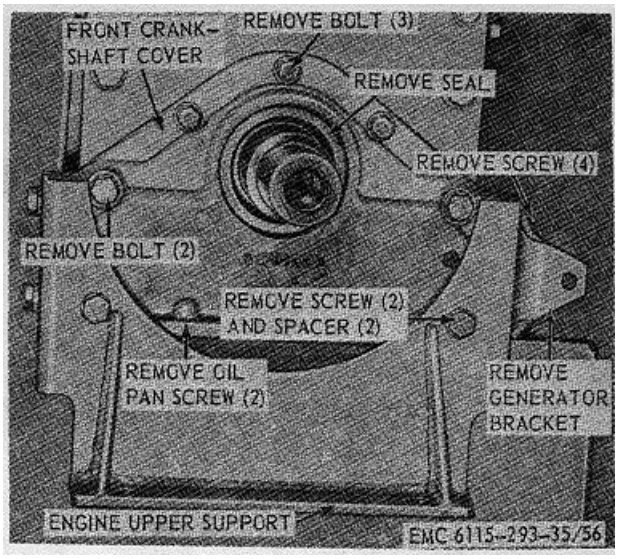


Figure 56. Engine upper support and front crankshaft cover, removal and installation.

Section XVIII. FLYWHEEL AND FLYWHEEL HOUSING

94. General

A combination flywheel housing and gear train cover, made of aluminum, is attached to the rear cylinder block end plate; it houses the flywheel and gear train. The cast iron flywheel is bolted securely to a flange on the crankshaft. A heat treated steel starter ring gear, having chamfered teeth, is shrunk-fit onto the rim of the flywheel.

95. Flywheel

a. Remove and install the engine (par. 36).

b. Remove and install the flywheel as shown by figure 57.

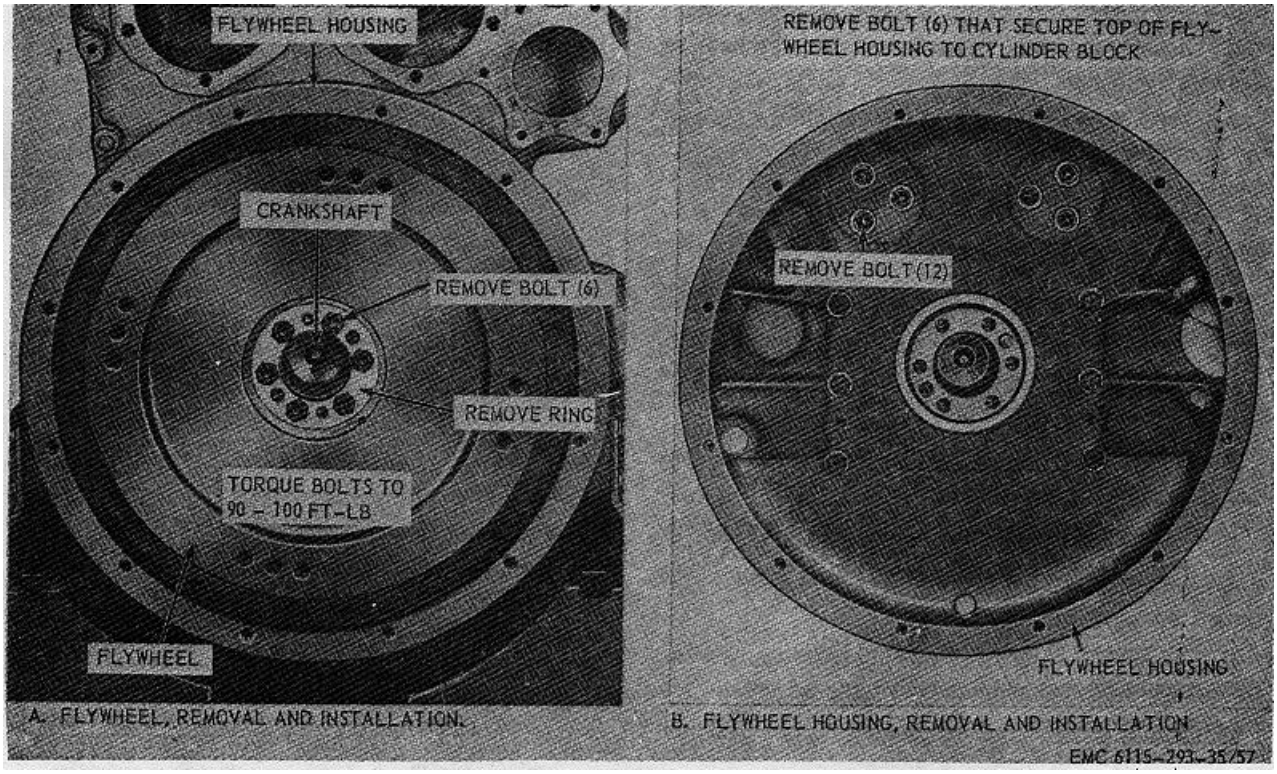
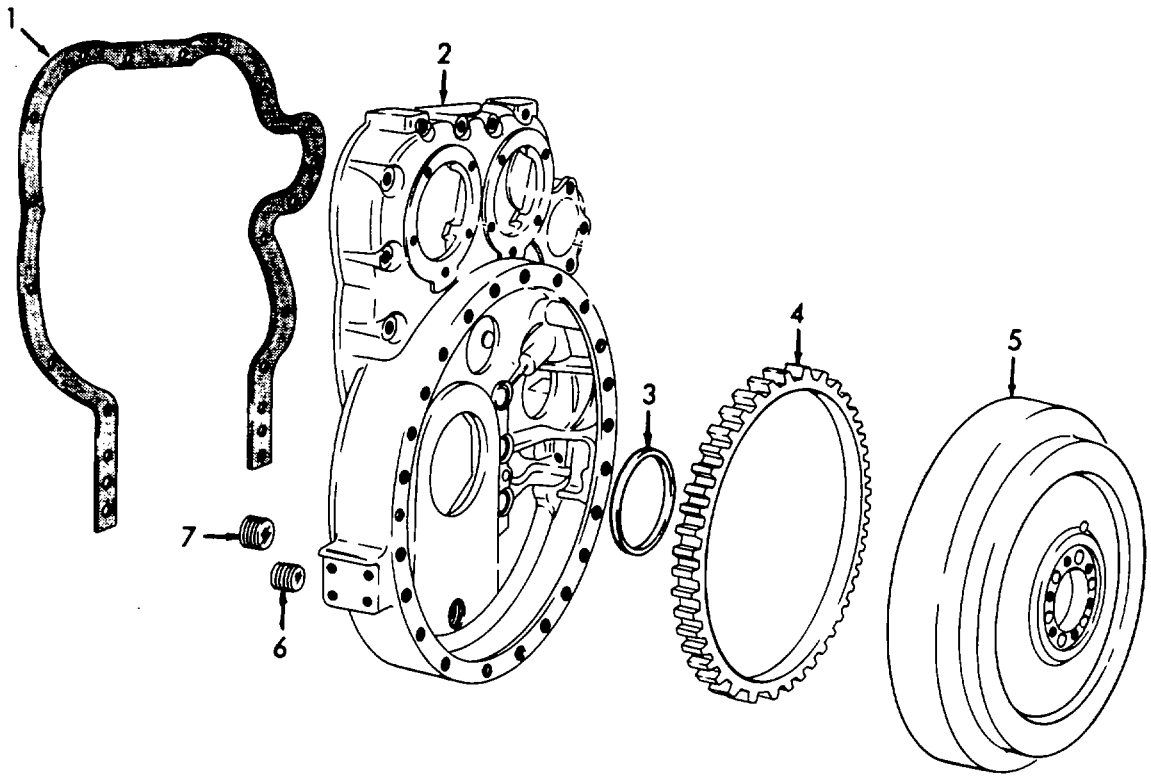


Figure 57. Flywheel and flywheel housing, removal and installation.



1 Gasket
2 Flywheel housing
3 Seal
4 Ring gear
5 Flywheel
6 Plug, pipe, 3/4-14
7 Plug, pipe, 1 x 1 in.

Figure 68. Flywheel and flywheel housing, disassembly and reassembly.

c. Disassemble and reassemble the flywheel as shown by figure 58.

Note.
The flywheel ring gear is shrunk onto the flywheel do not remove it unless it is damaged.

d. Clean, inspect, and repair.

96. Flywheel Housing

a. Remove and install the starter (TM 5-6115293-12).

b. Remove and install the fuel reservoir (par. 71).

c. Remove and install the governor drive assembly (par. 82).

d. Remove and install the flywheel (par. 95).

e. Remove and install the flywheel housing as shown by figure 57.

f. When installing the flywheel housing, use the torquing sequence shown by figure 59.

g. Disassemble and reassemble the flywheel housing as shown by figure 58.

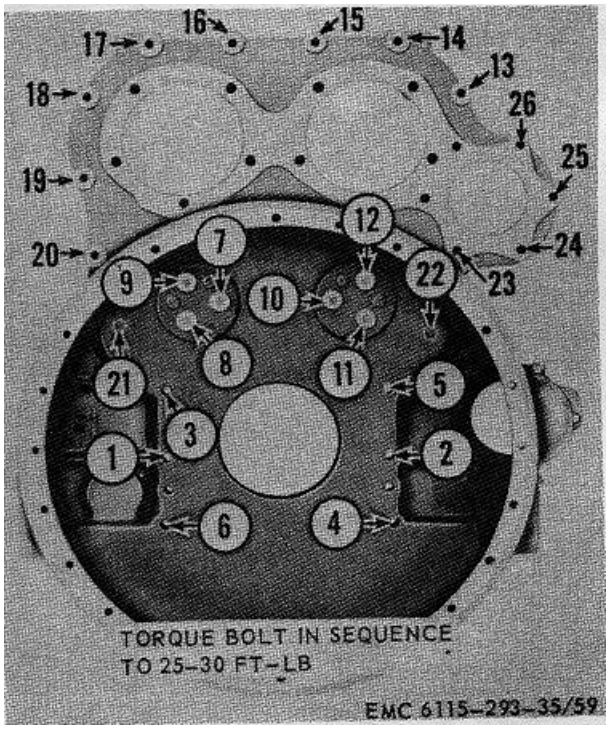


Figure 59. Flywheel housing bolts torque sequence.

Section XIX. GEAR TRAIN

97. General

The crankshaft gear, bolted to the crankshaft flange, drives the camshaft and balancer shaft gears, as well as the blower drive gear. It operates through an idler gear mounted between the crankshaft and camshaft gears. The camshaft gear and balancer shaft gear mesh with each other and run at the same speed as the crankshaft. These gears are keyed to their shafts and each is held securely on the shaft by a gear nut. The idler gear is fitted accurately with a bearing; it rotates on a stationary idler gear hub. A dummy hub covers the opening in the cylinder block end plate, which is the idler gear alternate mounting point.

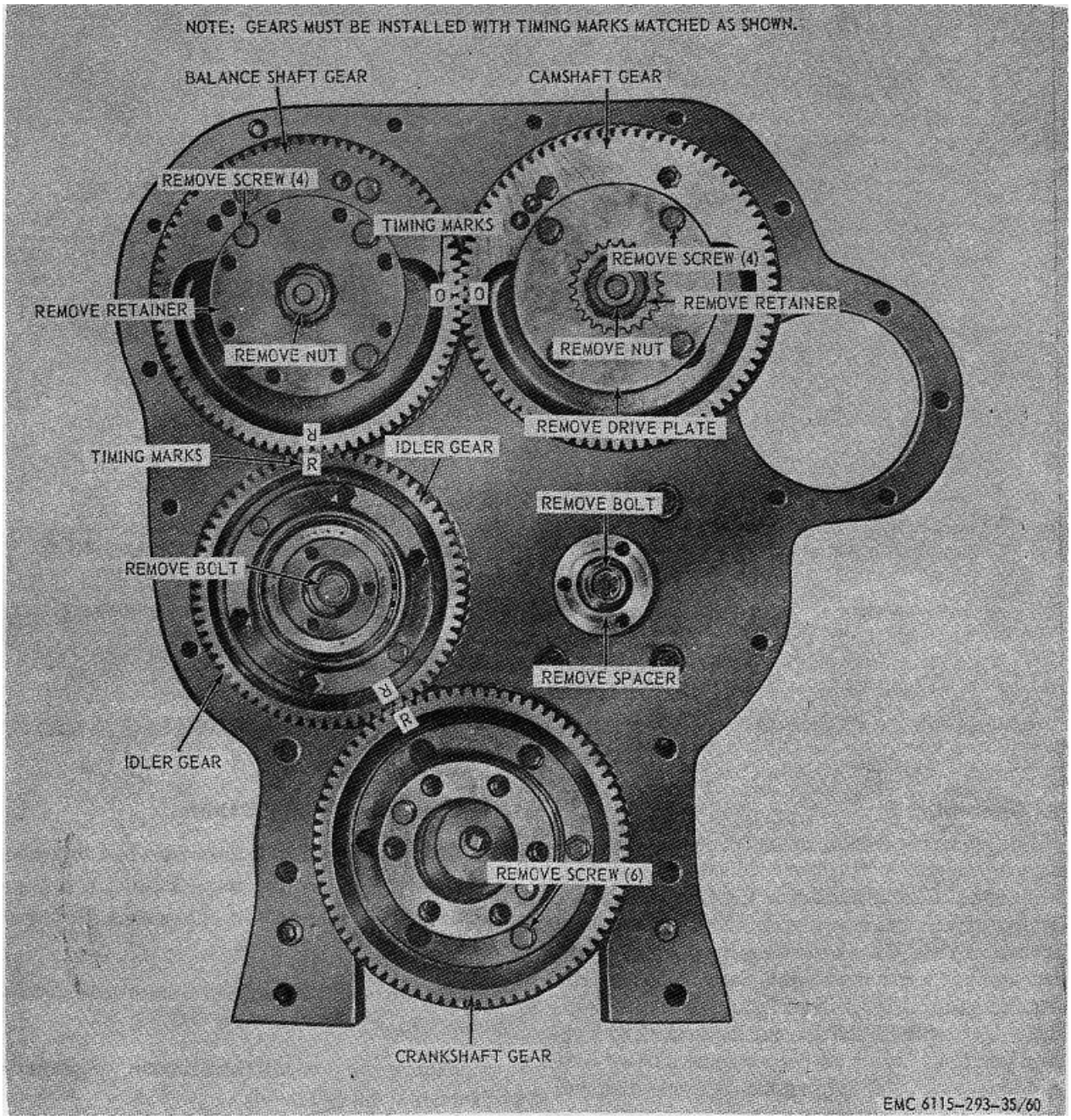


Figure 60. Gear train, removal and installation.

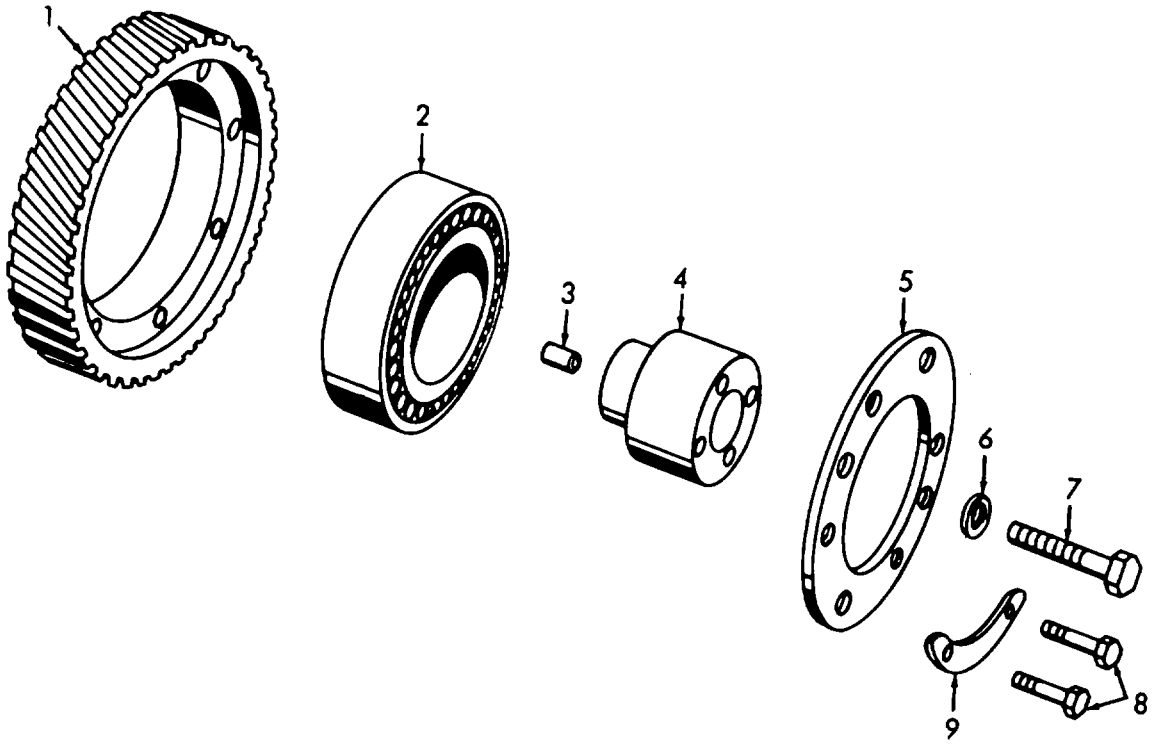
98. Gear Train

a. Remove and install the flywheel housing (par.

b. Remove and install the gear train as shown by figure 60.

c. Disassemble and reassemble the idler gear as shown by figure 61.

d. Clean, inspect, and repair.



EMC 6115–293–35/61

1 Helical gear
2 Tapered roller bearing
3 Dowel
4 Idler gear hub
5 Idler gear bearing retainer
6 Washer (spec)
7 Screw, cap, hex-hd, -13 x 2 dia.
8 Bolt, machine, K6-24 x M in. (6 rqr)
9 Idler gear lock plate (3 rqr)

Figure 61. Idler gear, disassembly and reassembly.

Section XX. BALANCER WEIGHT COVER, BALANCER WEIGHTS, CAMSHAFT, AND BALANCER SHAFT

99. General

The balancer weight cover encloses the two balancer weights which are attached to the forward ends of the camshaft and the balancer shaft. The camshaft, which operates the injectors and exhaust valves, is a one-piece drop forging with casehardened cams and journals. It is located near the top of the cylinder block on the blower side. A balancer shaft, running parallel to the crankshaft, is located on the opposite side of the cylinder block. The function of the balancer shaft is to counterbalance the rotation of the weighted camshaft.

100. Balancer Weight Cover

a. Remove and install the rectifier and bracket thermostat housing and bypass tube, fan pulley and hub, and governor output solenoid (TM-5 6115-293-12).

b. Remove and install the radiator and hood support (par. 39).

c. Remove and install the balancer weight cover as shown in figure 62.

d. Clean and inspect.

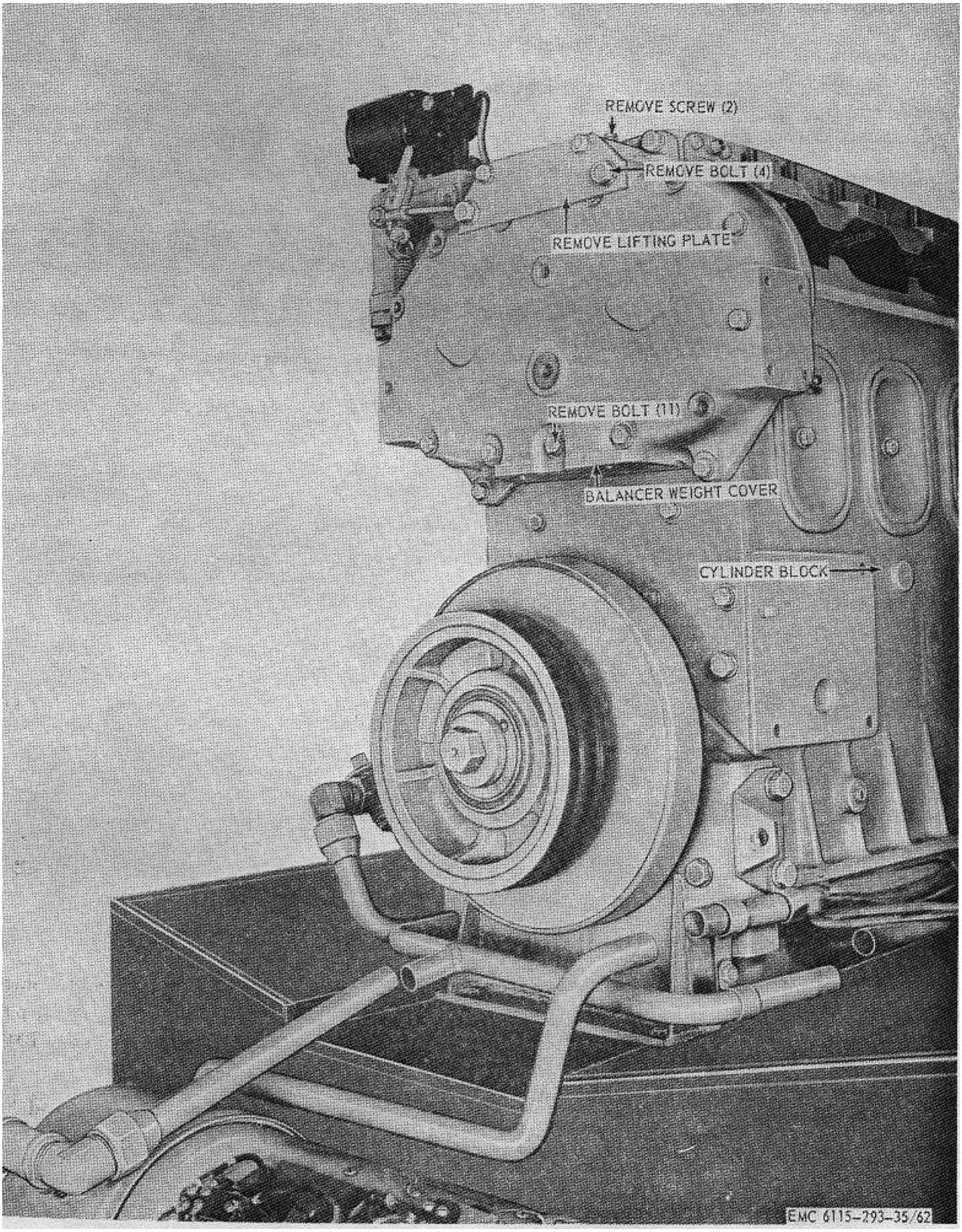


Figure 62. Balancer weight cover, removal and installation.

101. Balancer Weights

a. Remove and install the balancer weight cover (par. 100).

b. Remove and install the balancer weights as shown by figure 63.

c. Clean, inspect, and repair.

102. Camshaft and Balancer Shaft

a. Remove and install the cylinder head (par. 75).

b. Remove and install the balancer weights (par. 101).

c. Remove and install the flywheel housing (par. 96).

d. Disassemble and reassemble the camshaft and balancer shaft as shown by figure 64.

e. Clean, inspect, and repair.

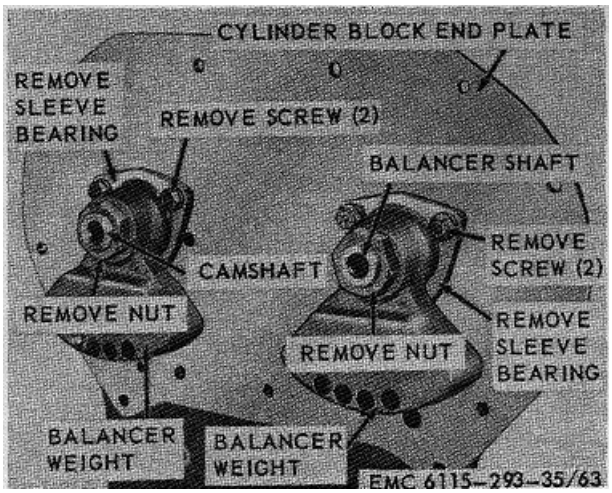
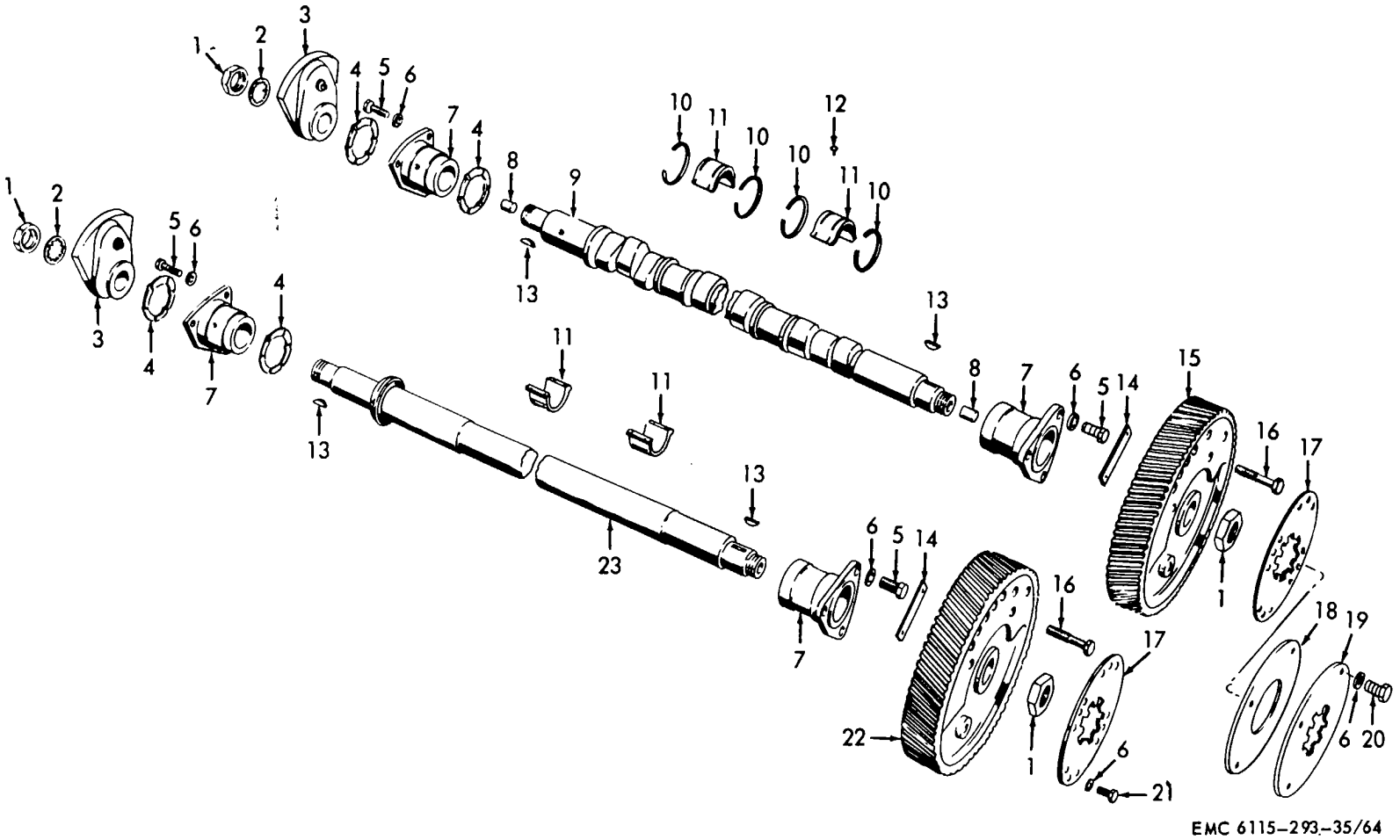


Figure 63. Balancer weights, removal and installation.



1 Nut, plain, hex, 1y-18 (2 rqr)
2 Washer, lock, 1s in. (2 rqr)
3 Balancer weight (2 rqr)
4 Thrust washer (spec) (4 rqr)
5 Screw, cap, hex-hd, 3s-16 x 1Y4 in. (12 rqr)
6 Washer, lock, %s in. (20 rqr)
7 Sleeve bearing (4 rqr)
8 Pin (spec) (2 rqr)
9 Camshaft
10 Retaining ring (10 rqr)
11 Bearing sleeve (10 rqr)
12 Setscrew (spec) (5 rqr)
13 Key, woodruff, No. 808 (4 rqr)
14 Weight (2 rqr)
15 Camshaft gear
16 Screw, cap, hex-hd, Y--24 x 1 A in. (4 rqr)
17 Nut retainer (2 rqr)
18 Spacer
19 Disk
20 Bolt, machine, hex-hd, 9-24 x 1 in. (4 rqr)
21 Bolt, machine, hex-hd, Y-24 x 78 in. (4 rqr)
22 Balancer shaft gear
23 Balancer shaft

Figure 64. Camshaft and balancer shaft, disassembly and reassembly.

Section XXI. ENGINE CONNECTING RODS AND PISTONS

103. General

Malleable cast-iron pistons are connected by piston pins to the upper end of drop-forged, carbon-steel connecting rods. The lower end of the connecting rods are attached to the crankshaft by bearing caps. The extra long piston skirts, accurately ground to full length, are plated with a protective coating of tin, which permits close fitting. Each piston is fitted with 6 rings of cut joint type. Four rings are located above the pin to seal compression and 2 are installed below the pin for the purpose of scraping excess lubricating oil from the cylinder walls.

104. Connecting Rods and Pistons

a. Remove and install the cylinder head (par. 75).

b. Remove and install the engine oil pump (par. 86).

c. Remove and install the connecting rods and pistons as shown by figure 65.

d. Disassemble and reassemble the connecting rods and pistons as shown by figure 66.

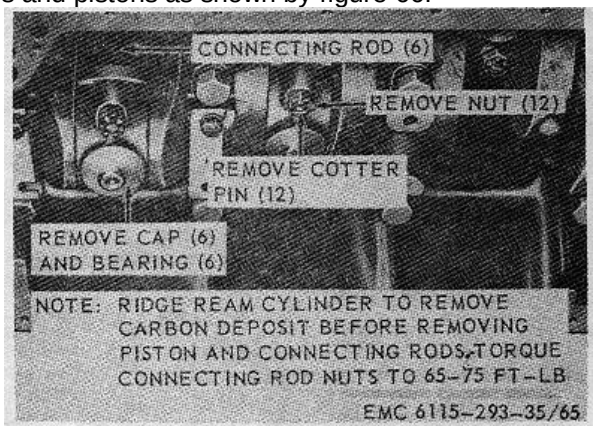
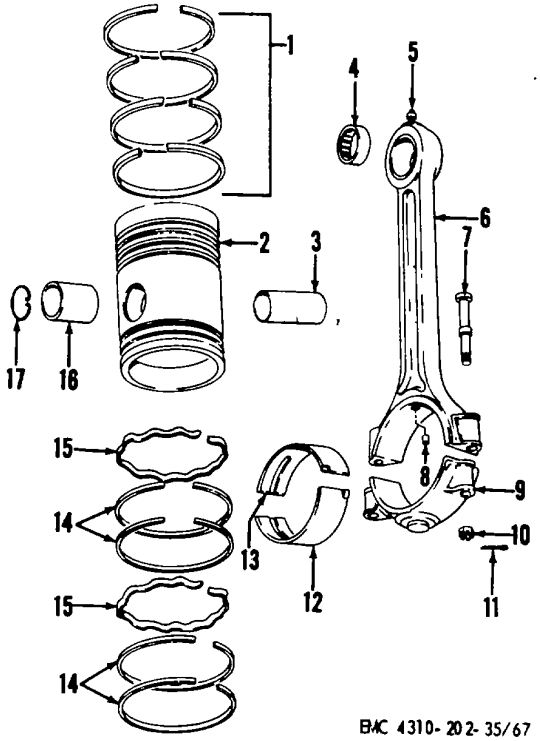


Figure 65. Connecting rods and pistons, removal and installation.



1 Compression ring (24 rqr)
2 Piston (6 rqr)
3 Pin (spec) (6 rqr)
4 Connecting rod bushing (12 rqr)
5 Connecting rod orifice (6 rqr)
6 Connecting rod (6 rqr)
7 Bolt (spec) (12 rqr)
8 Nozzle (6 rqr)
9 Bearing cap (6 rqr)
10 Nut, hex-hd, 7r-20 (12 rqr)
11 Pin, cotter, % x 1 in. (12 rqr)
12 Lower half sleeve bearing (6 rqr)
13 Upper half sleeve bearing (6 rqr)
14 Oil ring (24 rqr)
15 Ring expander (12 rqr)
16 Piston bushing (12 rqr)
17 Retaining ring (12 rqr)

Figure 66. Connecting rods and pistons, disassembly and reassembly.

e. Clean, inspect, and repair.

Section XXII. CRANKSHAFT AND MAIN BEARINGS

105. General The crankshaft is a high carbon-steel drop forging. It is heat-treated to insure utmost strength and durability. Positioned at regular intervals along the crankshaft are seven main bearings. The main bearing journals on the crankshaft are electrically hardened. The main bearing caps are numbered with a matching number stamped on the bottom of the blower side of the crankcase. The upper and lower bearings are of the precision type and are replaceable without machining. Each upper half contains an oil hole which alines with a hole in the cylinder block.

106. Crankshaft and Main Bearings

a. Remove and install the connecting rods and pistons (par. 104).

b. Remove and install the flywheel housing (par. 96).

c. Remove and install the front crankshaft cover (par. 93).

d. Remove and install the main bearings and crankshaft as shown by figure 67.

e. Disassemble and reassemble the engine crankshaft as shown by figure 68.

f. Clean, inspect, and repair.

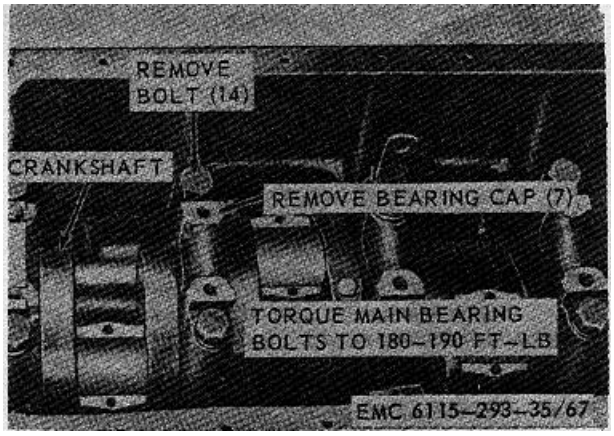
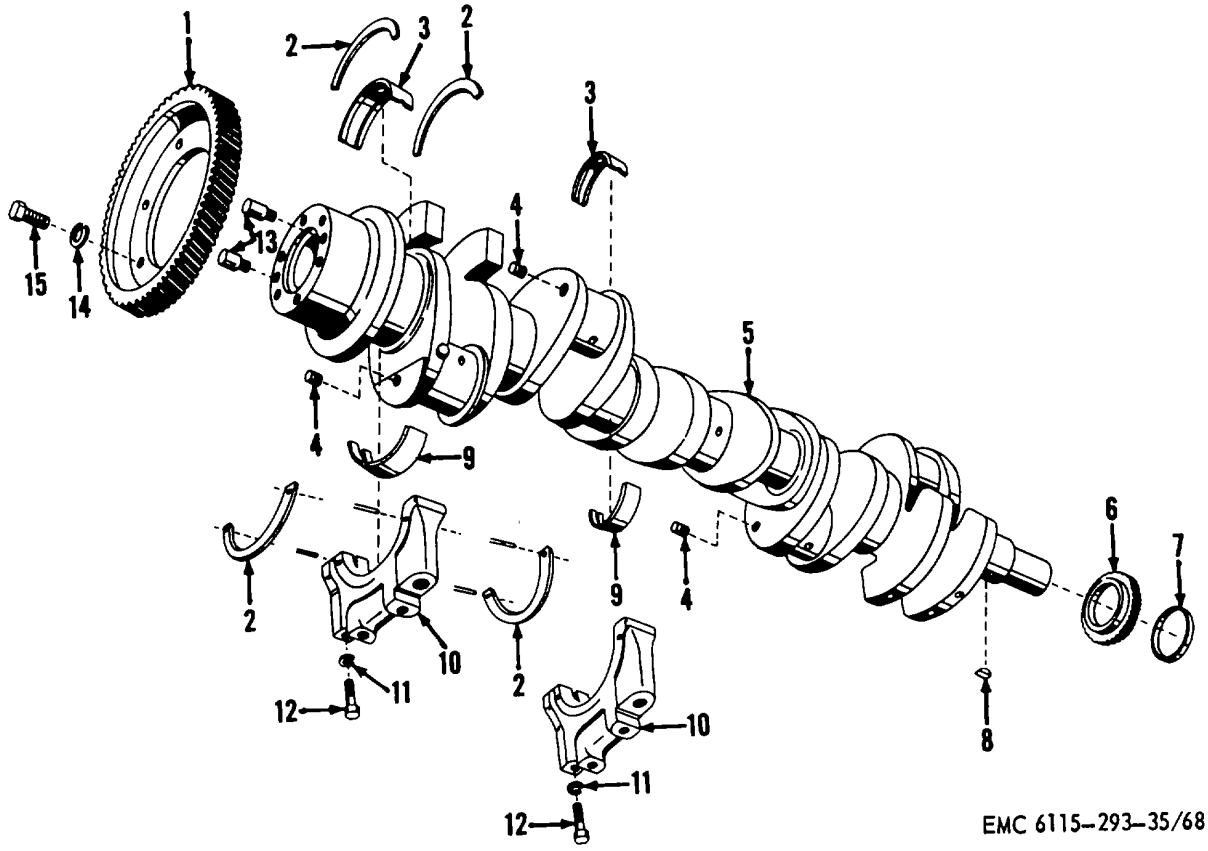


Figure 67. Crankshaft and main bearings, removal and installation.



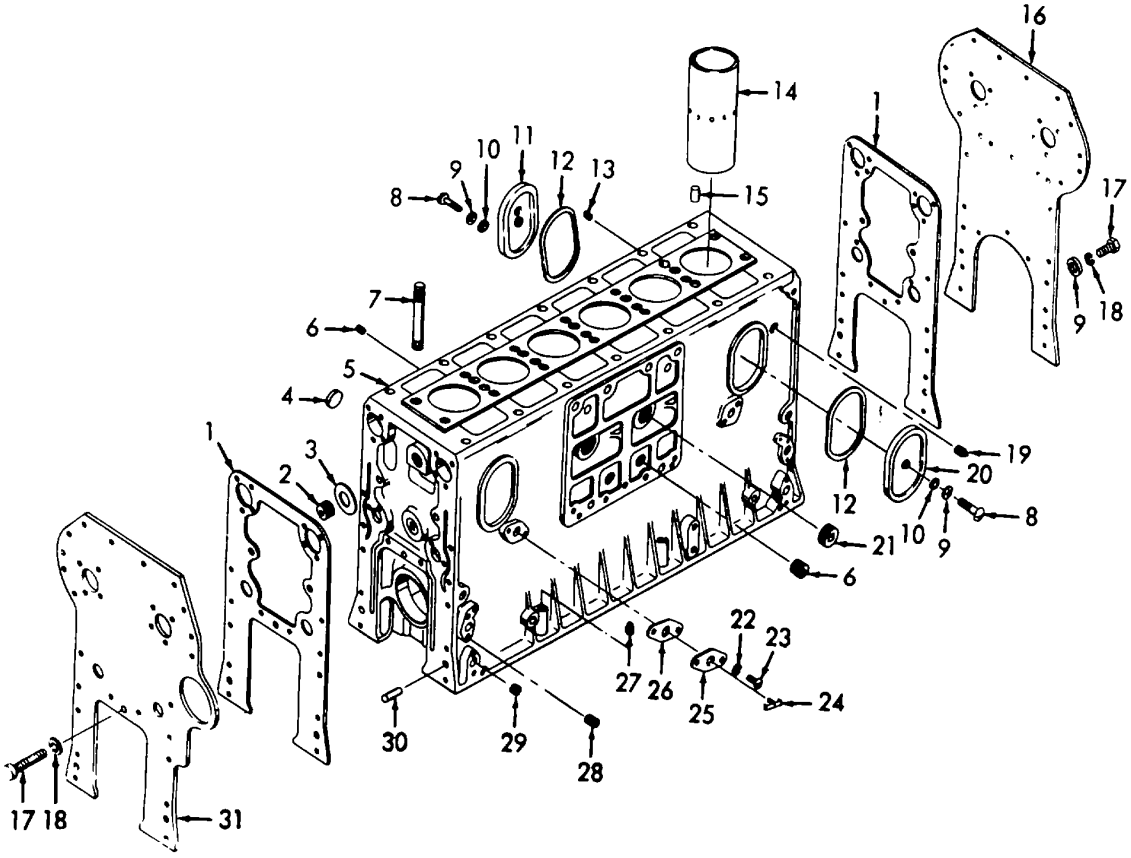
1 Crankshaft gear
2 Thrust washer (4 rqr)
3 Upper half bearing (7 rqr)
4 Plug, 4 in. (6 rqr)
5 Crankshaft
6 051 pump drive gear
7 Seal
8 Key, 5/8 X 3/4 in.
9 Lower half bearing (7 rqr)
10 Main bearing cap (7 rqr)
11 Washer, lock, K in. (14 rqr)
12 Screw, cap, A-18 x 4 Y4 in. (14 rqr)
13 Pin (spec) (2 rqr)
14 Washer, lock, Vs in. (6 rqr)
15 Screw, cap, M-24 x 1! in. (6 rqr)

Figure 68. Engine crankshaft, disassembly and reassembly.

Section XXIII. CYLINDER BLOCK AND LINERS

107. General

The cylinder block, which is the main structural part of the engine, is a box-like, one-piece casting made of alloy cast iron. The upper halves of the main bearing seats are cast integrally with the block. Cylinder bores are fitted with cylinder liners, into which a number of air inlet ports are drilled. The sleeves are of the replaceable type and have air inlet ports drilled through thin walls to permit air from the air box to enter the combustion chamber. The upper halves of the main bearing seats are cast integrally with the block. Flat end plates are bolted to each end of the cylinder block to permit attachment to the flywheel housing at the rear and the balancer weight cover at the front. The block has drilled passages for



1 End plate gasket (2 rqr)
2 Plug, Socket-hd, 1 1/4 in. (2 rqr)
3 Gasket (2 rqr)
4 Plug, expansion, 1 1/4 in. (2 rqr)
5 Cylinder block
6 Plug , 1/4 in. (5 rare
7 Stud, plain, 5/8-18 x 6 3/8 in. (2 rqr)
8 Bolt machine, 3/8-16 x 1 1/2 in. (8 rqr)
9 Washer, flat, 3/8 in. (10 rqr)
10 Gasket, copper, 3/8 in. (8 rqr)
11 Handhole cover
12 Gasket (8 rqr)
13 Plug, pipe, 1/4-18 (10 rqr)
14 Sleeve (6 rqr)
15 Pin, straight, 1/4 x 5/16 in. (4 rqr)
16 Front end plate
17 Bolt, machine, 3/8-16 x 1 in. (4 rqr)
18 Washer, lock, 3/8 in. (4 rqr)
19 Plug, pipe, 3/4 in. (2 rqr)
20 Handhold cover (7 rqr)
21 Plug, socket-hd, 1 in. (10 rqr)
22 Washer, lock, 5/16 in. (4 rqr)
23 Bolt, machine, 5/16-18 x 3/4 in. (4 rqr)
24 Draincock
25 Waterhole cover (2 rqr)
26 Gasket (2 rqr)
27 Plug, sq-hd, 1/4 in.
28 Plug, pipe, 1/2 in. (4 rqr)
29 Plug, pipe, 1/8 in.
30 Pin (spec) (4 rqr)
31 Rear end plate

Figure 69. Cylinder block, disassembly and reassembly.

carrying lubricating oil to all moving parts; this eliminates the need for oil tubing and connections.

108. Cylinder Block and Liners

a. Remove and install the rectifier, battery charging generator, generator regulator, and starter (TM 5-6115-293-12).

b. Remove and install the oil filters, oil cooler, and fuel strainer (TM 5-6115-293-12).

c. Remove and install the accessory drive (par. 65).

d. Remove and install the camshaft and balancer shaft (par. 102).

e. Remove and install the crankshaft (par. 106).

f. Disassemble and reassemble the cylinder block as shown by figure 69.

g. Clean, inspect, and repair.

Section XXIV. ENGINE LOWER FRONT SUPPORT

109. General

The engine lower front support is a one-piece steel support which is used to support the front of the engine. It is bolted to the two crossmembers of the skid base. The engine upper front support is bolted directly to the engine lower front support.

110. Engine Lower Front Support

a. Remove and install the battery box panels and door stops (par. 42).

b. Remove and install the engine (par. 36).

c. Remove and install the engine lower front support as shown by figure 70.

d. Clean and inspect

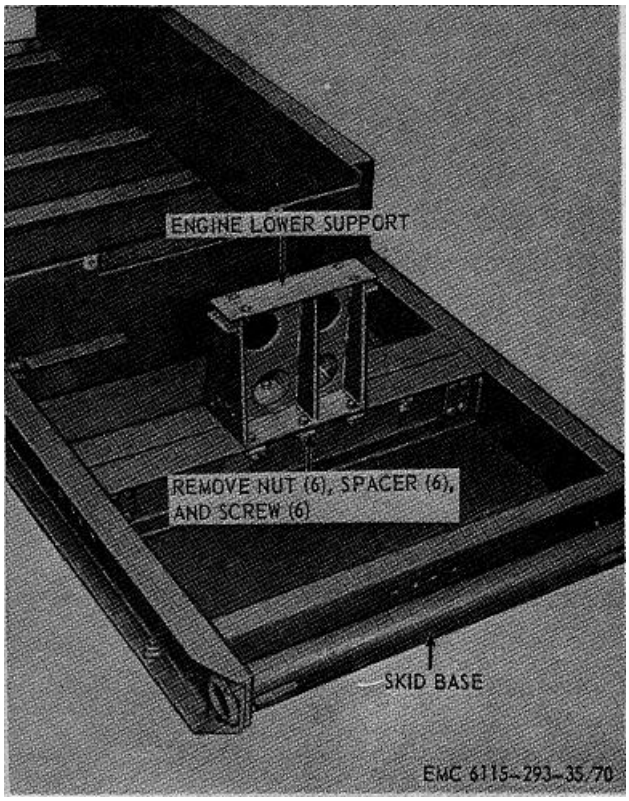


Figure 70. Engine lower front support, removal and installation.

Section XXV. FUEL TANK

111. General

The welded-steel fuel tank is mounted in the skid base beneath the generator set.- It is secured to the skid base with two straps.

112. Fuel Tank

a. Drain and fill the fuel tank (TM 5-611529312).

b. Disconnect and reconnect the fuel tank lines (TM 5-6115-293-12).

c. Remove and install the fuel tank vent line and fuel gage (TM 5-6115-293-12).

d. Remove and install the skid base end support (par. 46).

e. Remove and install the fuel tank as shown by figure 71.

f. Clean, inspect, and repair.

Warning

Fill the fuel tank with water before soldering or brazing. Failure to observe this warning may result in serious injury to personnel.

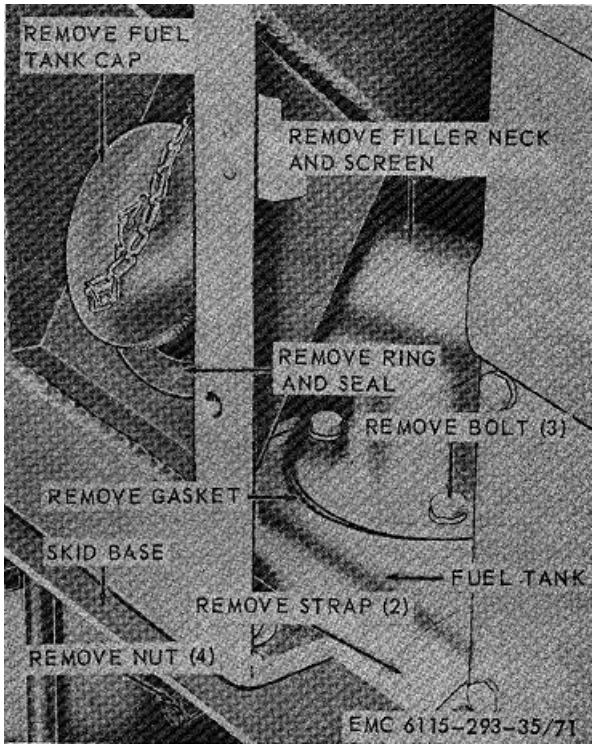


Figure 71. Fuel tank, removal and installation.

CHAPTER 5
CONTROL BOX, CIRCUIT BREAKER, LOAD CONNECTORS, AND TERMINAL BLOCK REPAIR INSTRUCTIONS

Section I. CONTROL BOX

113. General

The various controls for the generator are located in the control box. The generator voltage rheostat, governor droop resistor, frequency meter, and kilowatt meter are located on the control box door. The overvoltage relay, crosscurrent rheostat, synchronizing lamp resistors, relays, and receptacles are located inside the control box.

Warning

Before performing maintenance on this generator set, be sure the unit is not operating or connected to another generator set that is operating.

114. Generator Voltage Rheostat

a. Remove and install the generator voltage rheostat as shown by figure 72.

b. Clean and inspect.

c. Test after removal as follows:

(1) Use a multimeter and measure the resistance between the outside terminals of the rheostat. If a reading of more than 10 percent above or below 2,500 ohms is obtained, the rheostat is defective and must be replaced.

(2) Connect the multimeter to the center terminal and one of the outside terminals. Rotate the rheostat through its range. The resistance must vary smoothly from zero to maximum ohms. Replace a defective rheostat.

115. Governor Droop Resistor

a. Remove and install the governor droop resistor as shown by figure 72.

b. Clean and inspect.

c. Test the governor droop resistor in a manner similar to that used in testing the generator voltage rheostat (par. 114). The resistance must be within 10 percent above or below 25 ohms.

116. Frequency Meter and Converter

a. Bring the generator set up to operating temperature. Using a tachometer, adjust the speed to 1,800 rpm. The frequency meter must indicate 60 cycles. If the frequency meter does not indicate 60 cycles, the frequency meter and/or the converter are defective and both units must be replaced as a pair.

b. Remove and install the frequency meter and converter as shown by figure 72.

Note

The frequency meter and converter are matched and must be replaced as a pair.

c. Clean and inspect.

117. Kilowatt Meter and Thermal Watt Converter

a. Use a suitable load bank and apply a 60-kw, 3-phase, 208v load on the generator set. If the kilowatt meter does not indicate 60 kw ± 5 percent, the kilowatt meter and/or thermal watt converter are defective and both units must be replaced as a pair.

b. Remove and install the kilowatt meter and thermal watt converter as shown by figure 72.

Note

The kilowatt meter and thermal watt converter are matched and must be replaced as a pair.

c. Clean and inspect.

118. Overvoltage Relay

a. Remove and install the overvoltage relay as shown by figure 73.

b. Clean and inspect.

119. Crosscurrent Rheostat

a. Remove and install the crosscurrent rheostat as shown by figure 73.

b. Clean and inspect.

c. Test after removal as follows:

(1) Use a multimeter and measure the resistance

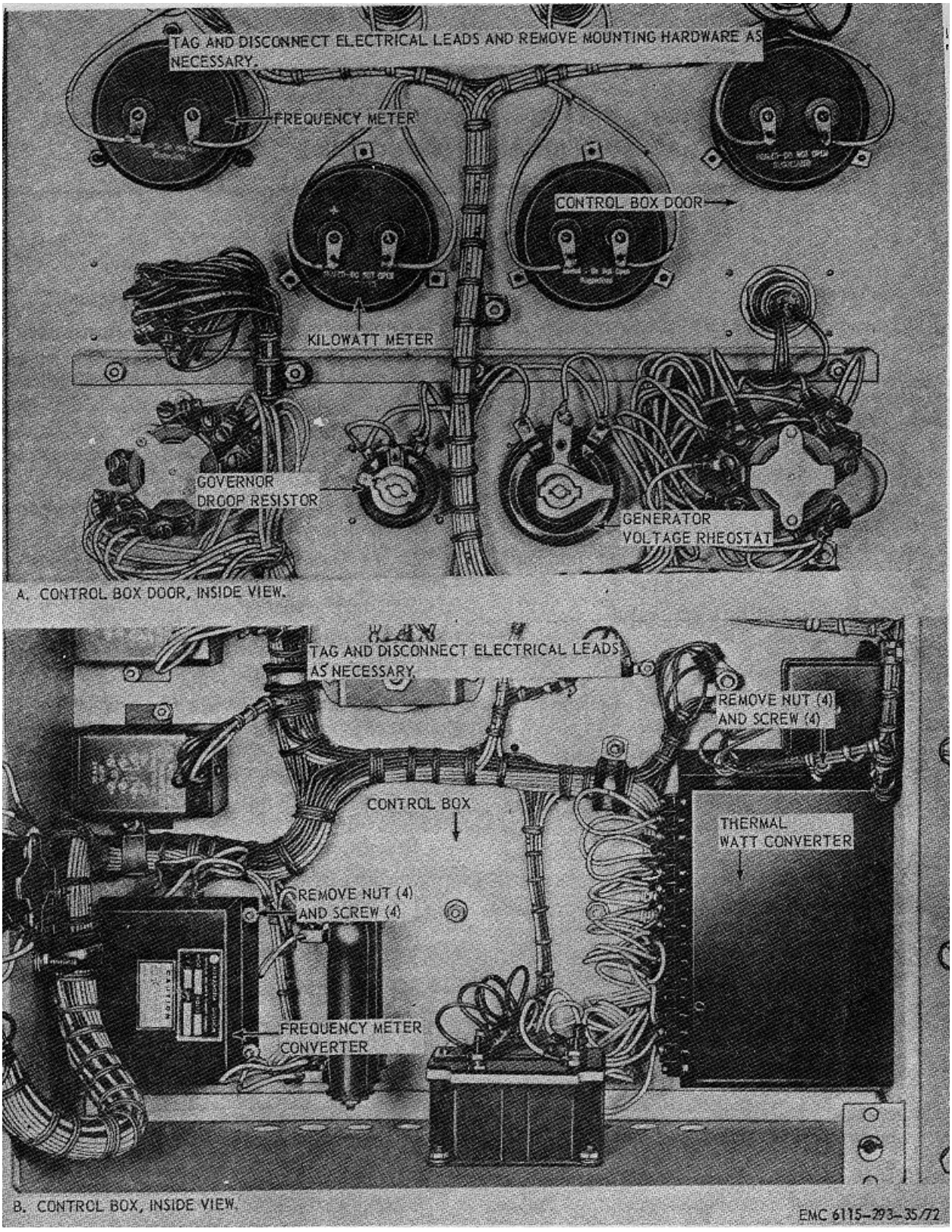


Figure 72. Generator voltage rheostat, governor droop resistor, frequency meter, and kilowatt meter, removal and installation.

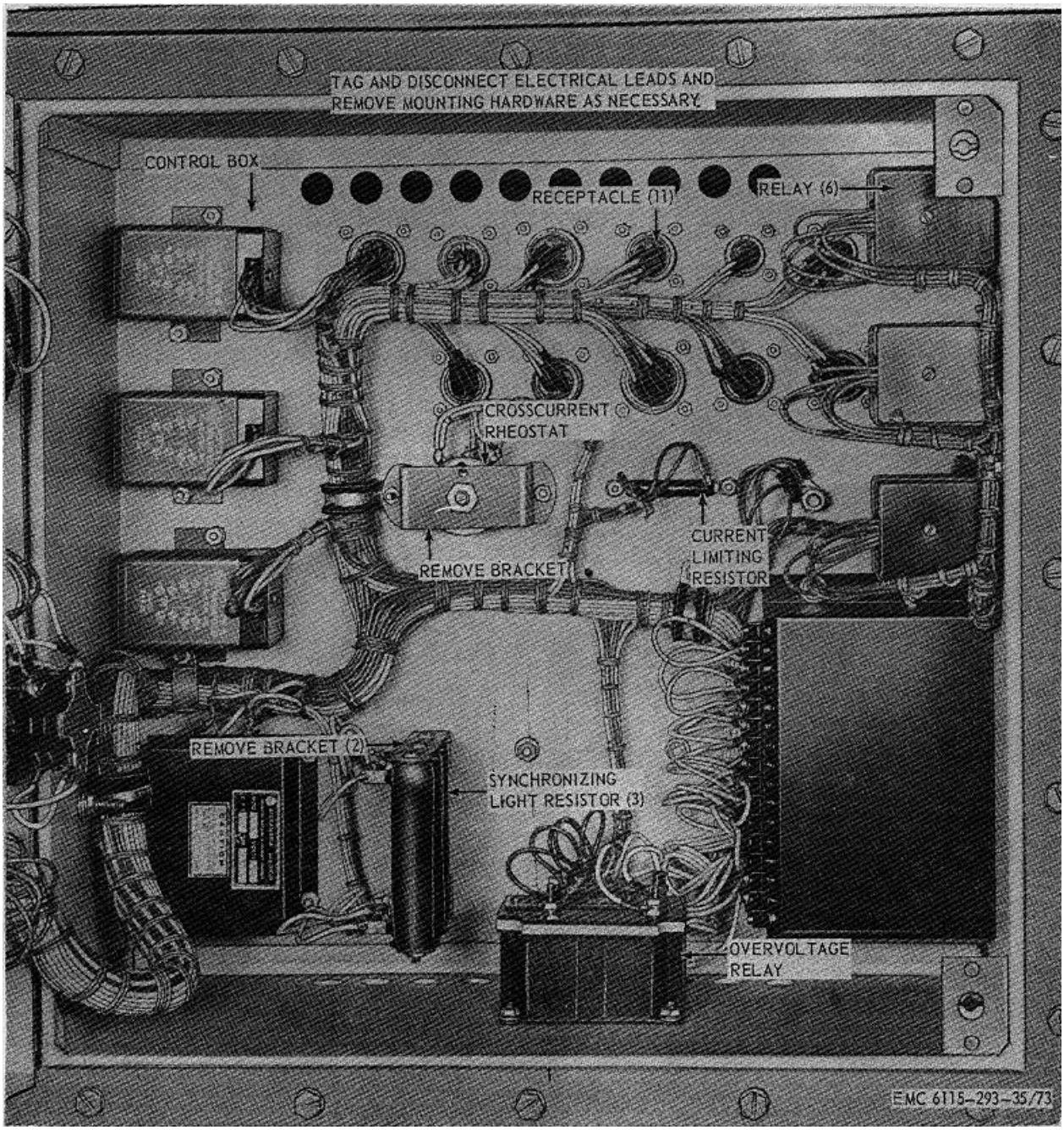


Figure 73. Control box relays, rheostats, resistors, and receptacles, removal and installation.

between the outer terminals of the rheostat. If a reading or more than 10 percent above or below 10 ohms is obtained, the rheostat is defective and must be replaced.

(2) Connect the multimeter to the center terminal and to one of the outer terminals. Rotate the rheostat through its range. The resistance should vary smoothly from zero to maximum. Replace a defective rheostat.

d. Adjust as follows:

(1) Connect the generator set in parallel with the generator set with which it is to be operated (TM 5-6115-293-12).

(2) Connect an ammeter in the external load line to read the total current in one phase.

(3) Start and parallel the generator sets (TM 5-6115-293-12).

(4) Turn the voltmeter-ammeter switch on each generator set to read current in the same phase as the external load line ammeter.

(5) Apply a 0.6 power factor load not exceeding the ampere rating of the generator sets.

(6) The sum of the readings of the generator ammeters should equal the reading of the external load line ammeter and the ampere load division should prevail while varying the load between one-third and full load.

(7) Adjust the crosscurrent rheostat to carry the generator set's share of the load as shown by figure 74.

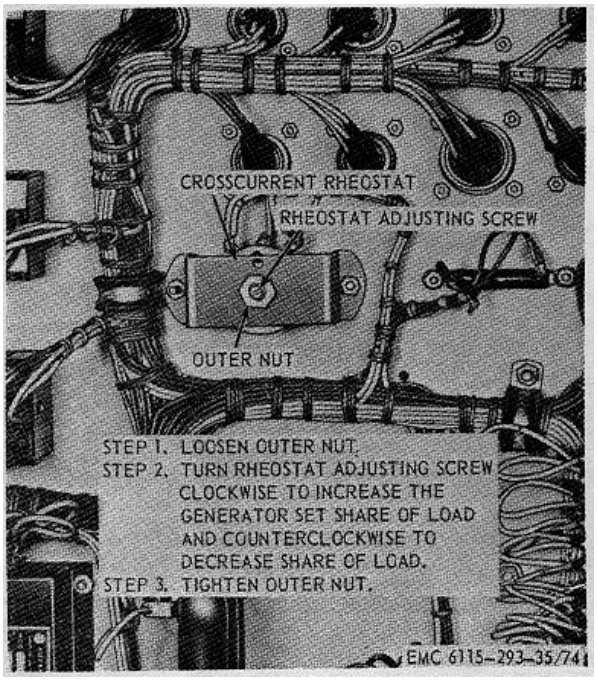


Figure 74. Crosscurrent rheostat adjustment.

120. Synchronizing Light Resistors

a. Remove and install the synchronizing light resistor as shown by figure 73.

b. Clean and inspect.

c. Tag and disconnect the electrical leads from the resistor. Using a multimeter, measure the resistance between the terminals of the resistor. The resistance must be between 9,000 and 11,000 ohms.

d. Remove, install, and test the remaining two synchronizing light resistors in a similar manner.

121. Current Limiting Resistor

a. Remove and install the current limiting resistor as shown by figure 73.

b. Clean and inspect.

c. Test the resistor by measuring across the terminals with a multimeter. The resistance must be between 360 and 440 ohms.

122. Relays

a. Remove and install the relays as shown by figure 73.

b. Clean and inspect.

c. Test the relays by comparing the values obtained with a relay known to be working properly.

123. Receptacles

a. Remove and install the receptacles as shown by figure 73.

b. Clean and inspect.

124. Control Box

a. Remove and install synchronizing lights, instrument lights, overvoltage light, current meter, voltmeter, meter and parallel operation switch, and toggle switches (TM 5-6115-293-12).

b. Remove and install the generator voltage rheostat (par. 114).

c. Remove and install the governor droop resistor (par. 115).

d. Remove and install the frequency meter and converter (par. 116).

e. Remove and install the kilowatt meter and thermal watt converter (par. 117).

f. Remove and install the overvoltage relay (par. 118).

g. Remove and install the crosscurrent rheostat (par. 119).

h. Remove and install the synchronizing lamp resistor (par. 120).

i. Remove and install the current limiting resistor (par. 121).

j. Remove and install the relays (par. 122).

k. Remove and install the receptacles (par. 123).

l. Remove and install the control box as shown by figure 75.

m. Clean and inspect.

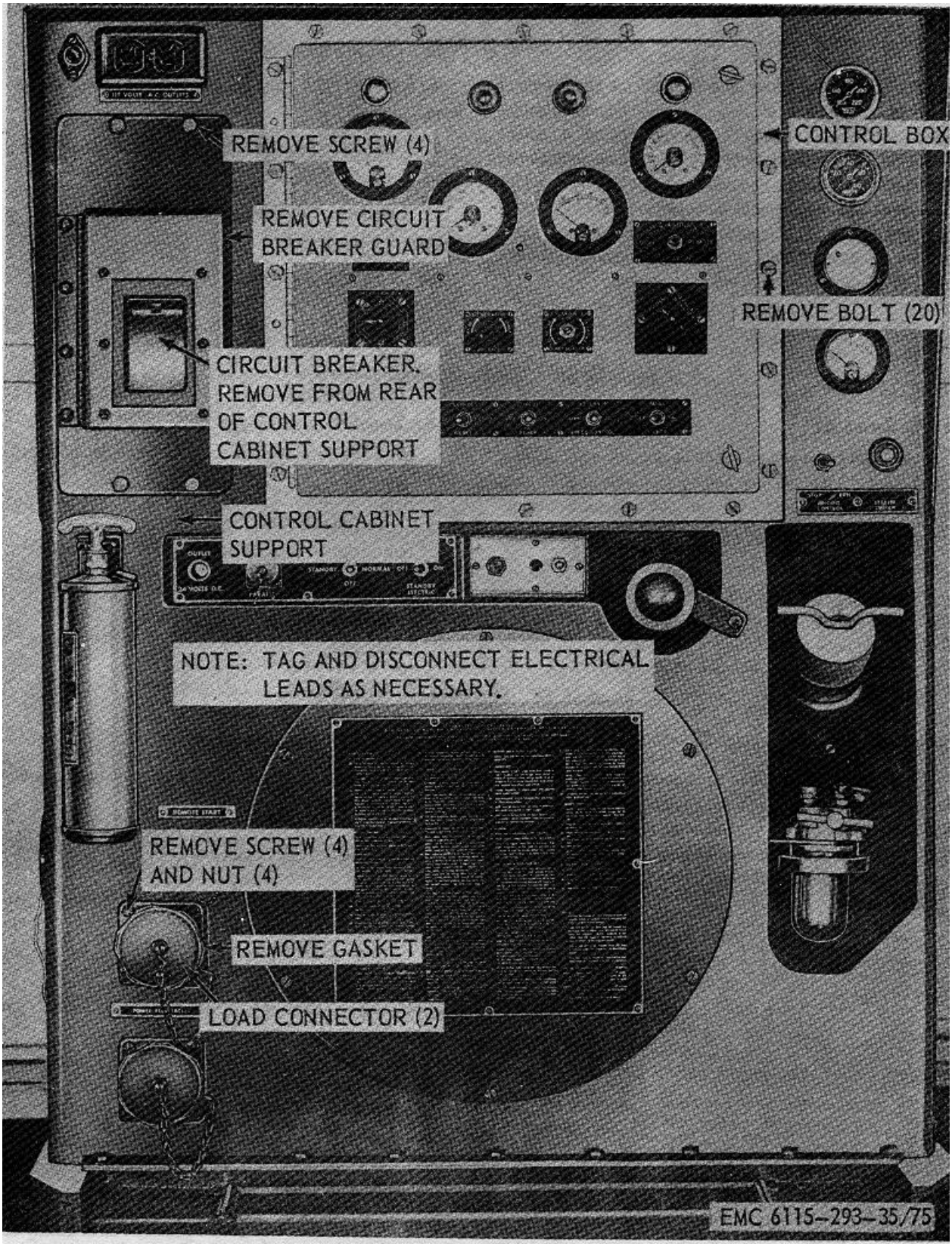


Figure 75. Control box, circuit breaker, and load connectors, removal and installation.

Section II. CIRCUIT BREAKER

125. General

The circuit breaker is mounted on the control cabinet support. It is a three-pole, manually operated circuit breaker, incorporating a series time delay overload switch and an instantaneous magnetic short-circuit undervoltage trip coil. The undervoltage trip coil is actuated separately from the operating handle and the circuit breaker cannot be manually held in if an overload, short-circuit, or undervoltage condition exists.

126. Circuit Breaker

a. Remove and install the control cabinet support (par. 41).

b. Remove and install the radio suppression capacitors (TM 5-6115-293-12).

c. Remove and install the circuit breaker as shown by figure 75.

d. Clean and inspect.

Section III. LOAD CONNECTORS

127. General

Two load connectors are mounted on the control cabinet support. They are of the four-pin female type and are provided for the purpose of connecting power lines in operation.

128. Load Connectors

a. Remove and install the control cabinet support (par. 41).

b. Remove and install the radio suppression capacitor (TM 5-6115-293-12).

c. Remove and install the load connectors as shown by figure 75.

d. Clean and inspect.

Section IV. TERMINAL BLOCK

129. General

The terminal block is mounted on the left side of the static exciter. The generator stator output leads are connected to the excitation transformer and the terminal block. The changeover board provides a convenient means of selecting operating voltages.

130. Terminal Block

a. Remove and install the terminal block cover (TM 5-6115-293-12).

b. Remove and install the terminal block, bus bars, and terminals as shown by figure 76.

c. Clean, inspect, and repair.

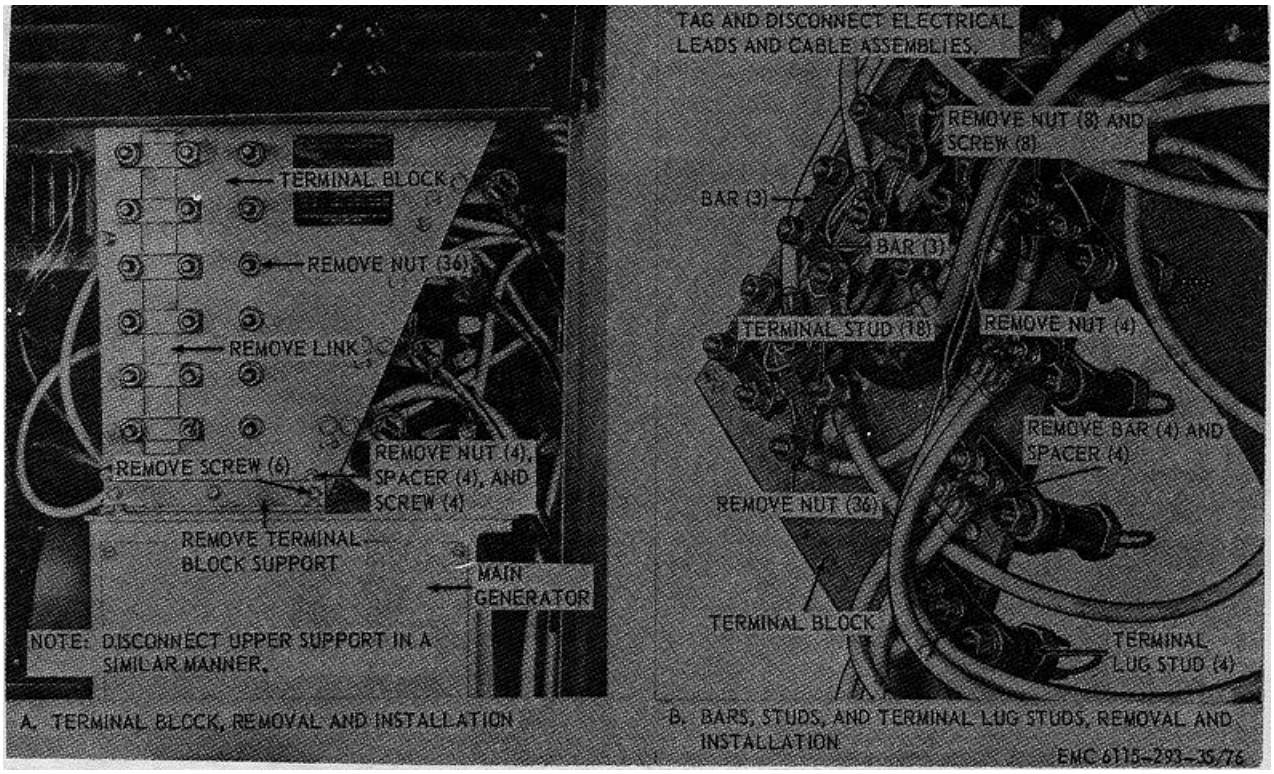


Figure 76. Terminal block, bus bars, and terminals, removal and installation.

Section I. VOLTAGE REGULATOR

131. General

The voltage regulator is mounted on the right side of the exciter and functions to maintain a constant output voltage under varying loads by sampling or sensing the ac voltage on one of the 120-volt phase windings of the main generator. This sensed voltage is then rectified and amplified in the voltage regulator and used as the control current in the static exciter magnetic amplifier.

132. Voltage Regulator

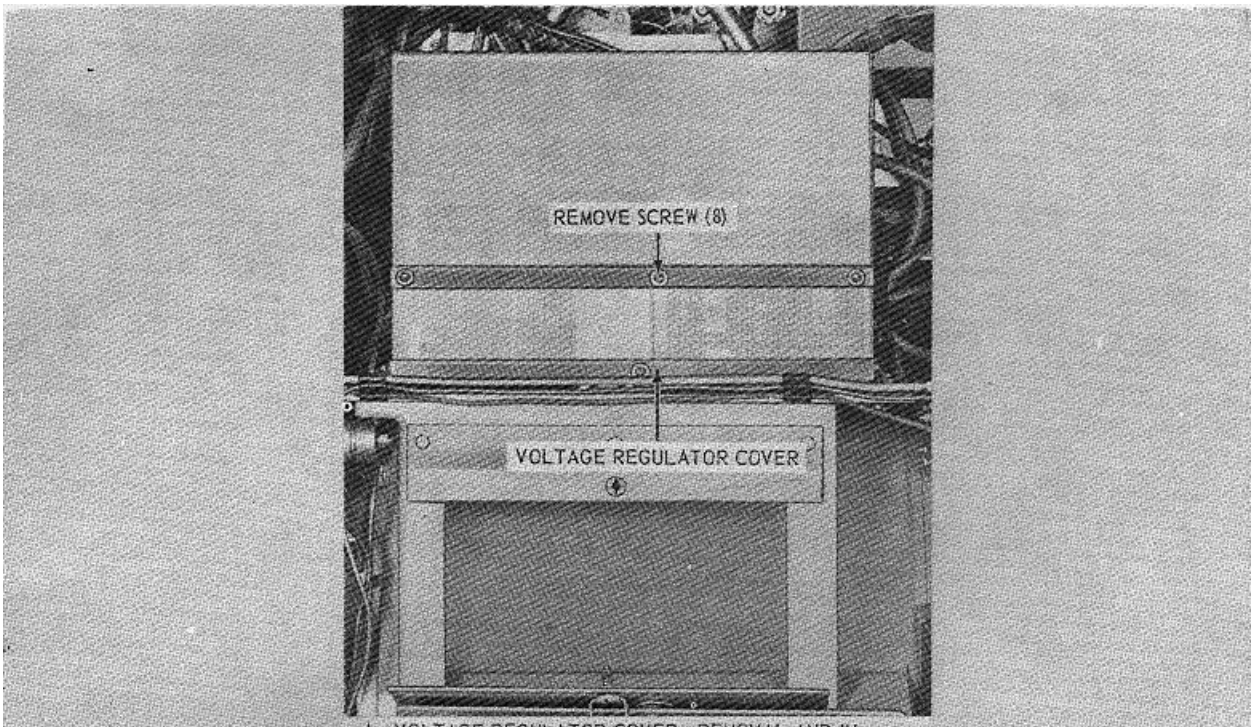
a. Remove and install the voltage regulator as shown by figure 77.

b. Remove and install the magnetic amplifier, resistors, capacitors, and rectifier as shown by figure 78.

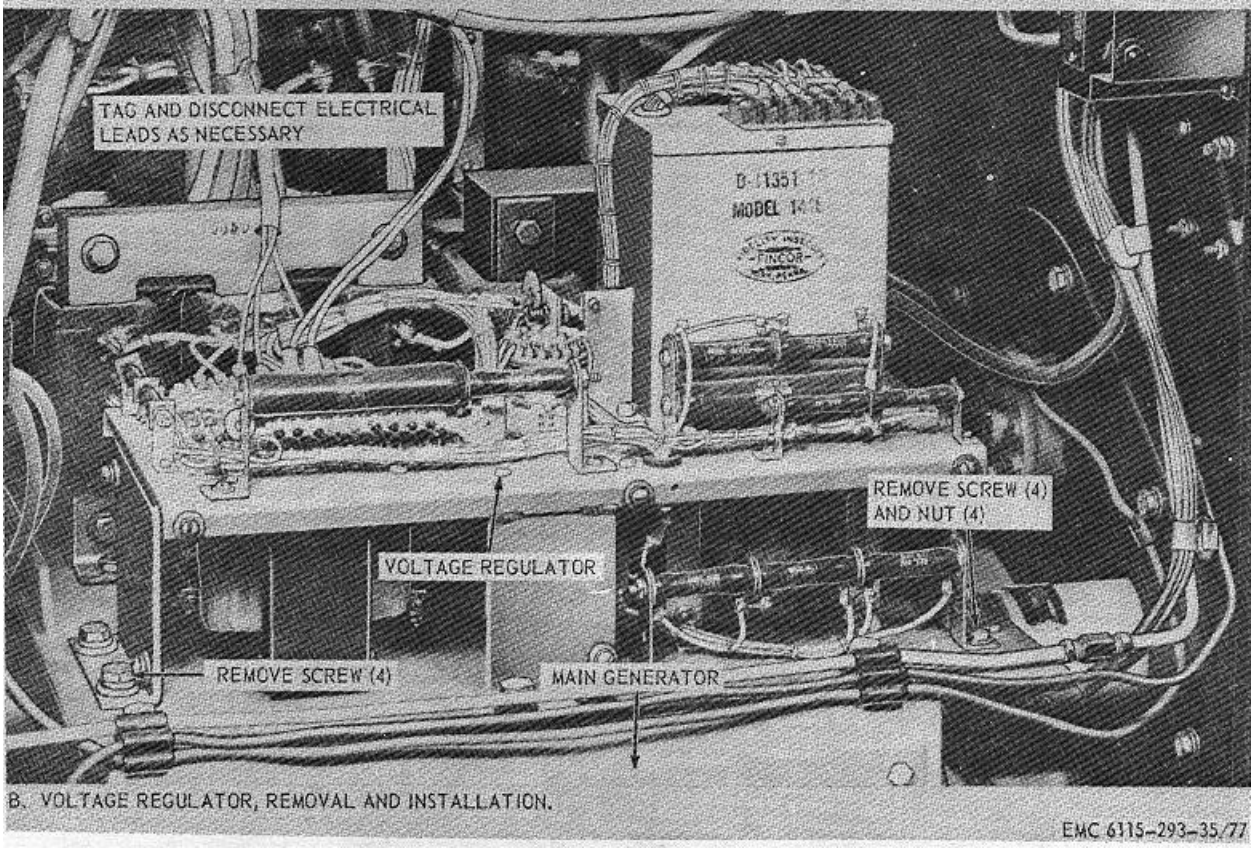
c. Remove and install the filter choke and transformer as shown by figure 79.

d. Clean, inspect, and repair.

e. Test the removed components by comparison of values with those of components known to be accurate.



A. VOLTAGE REGULATOR COVER, REMOVAL AND INSTALLATION.



B. VOLTAGE REGULATOR, REMOVAL AND INSTALLATION.

EMC 6115-293-35/77

Figure 77. Voltage regulator, removal and installation.

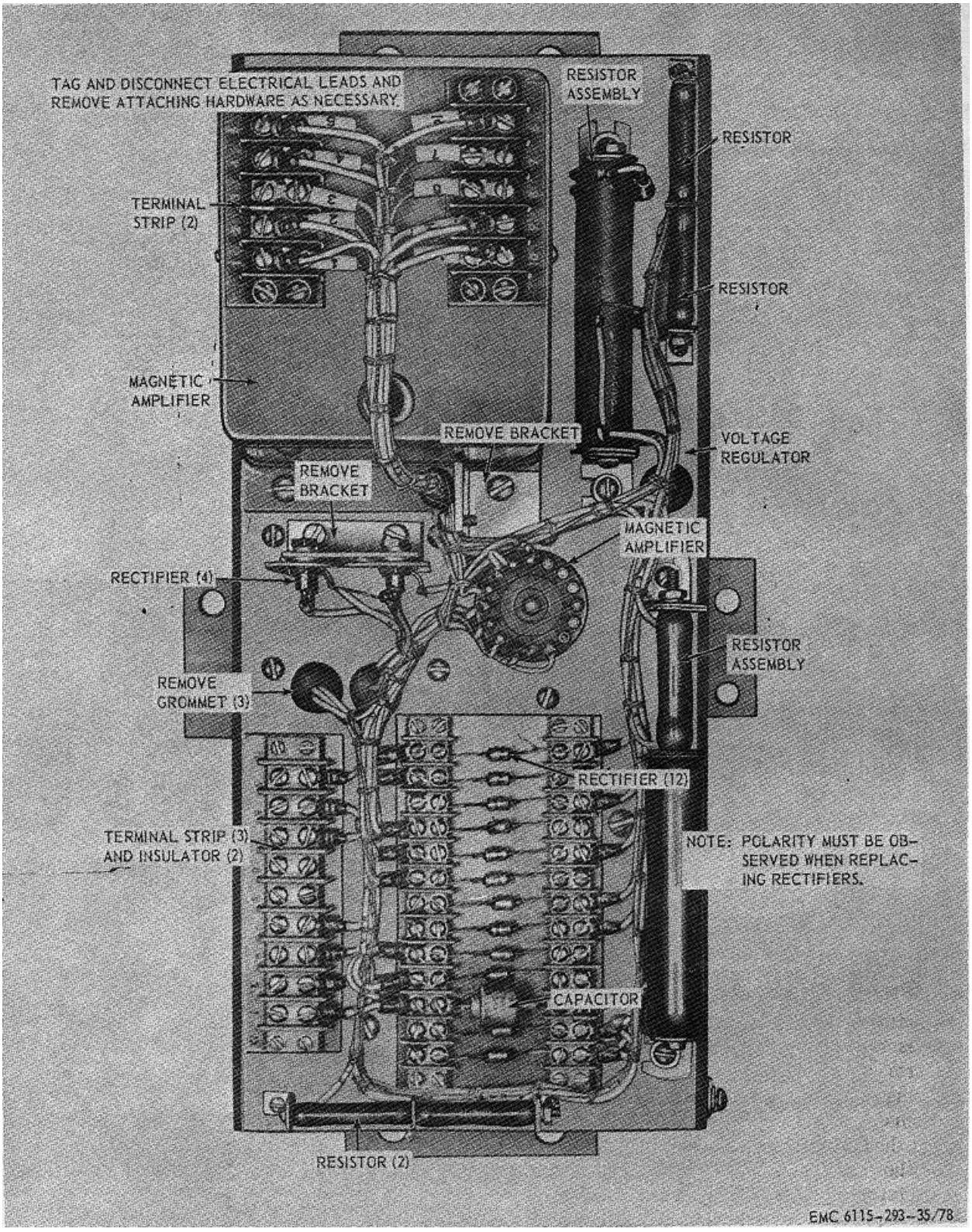


Figure 78. Magnetic amplifiers, resistors, capacitors, and rectifiers, removal and installation.

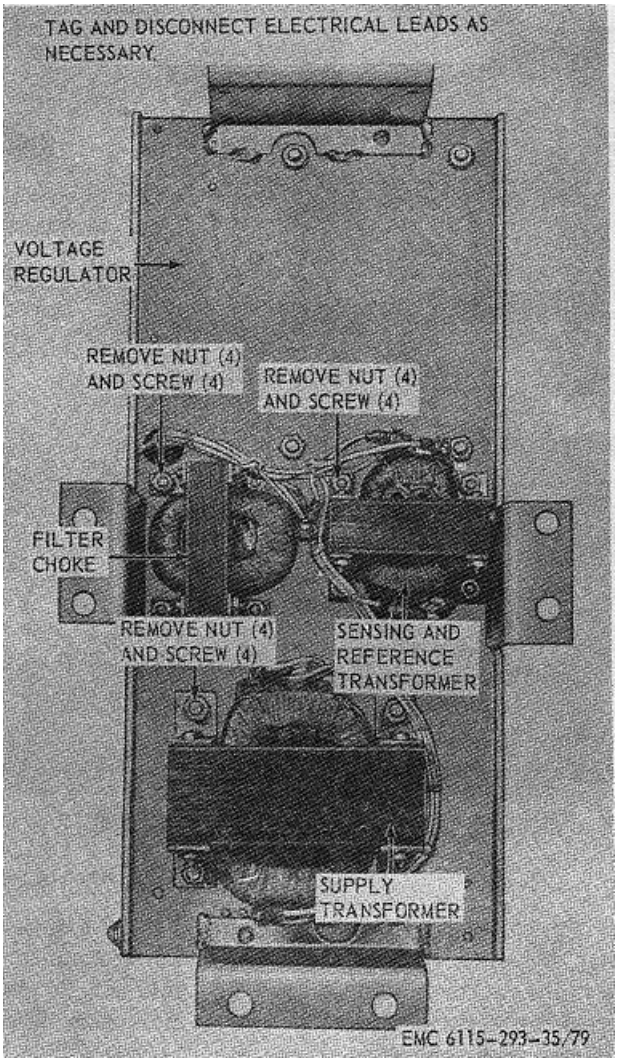


Figure 79. Filter choke and transformer, removal and installation.

Section II. STATIC EXCITER

133. General

The static exciter consists mainly of 3 single-phase excitation transformers, a 3-phase reactor transformer, antihunt choke and transformer, stabilizing resistors, and a heat sink. The heat sink includes a bridge rectifier of 6 diodes, which convert the alternating current to direct current to excite the rotating field of the main generator. The excitation transformers are controlled by the voltage regulator to vary the excitation to the main generator, as required to maintain a constant output voltage.

134. Static Exciter

a. Remove and install the control cabinet support (par. 41).

b. Remove and install the terminal block (par. 130).

c. Remove and install the voltage regulator (par. 132).

d. Remove and install the static exciter, as shown by figure 80.

e. Remove and install the heat sink as shown by figure 81.

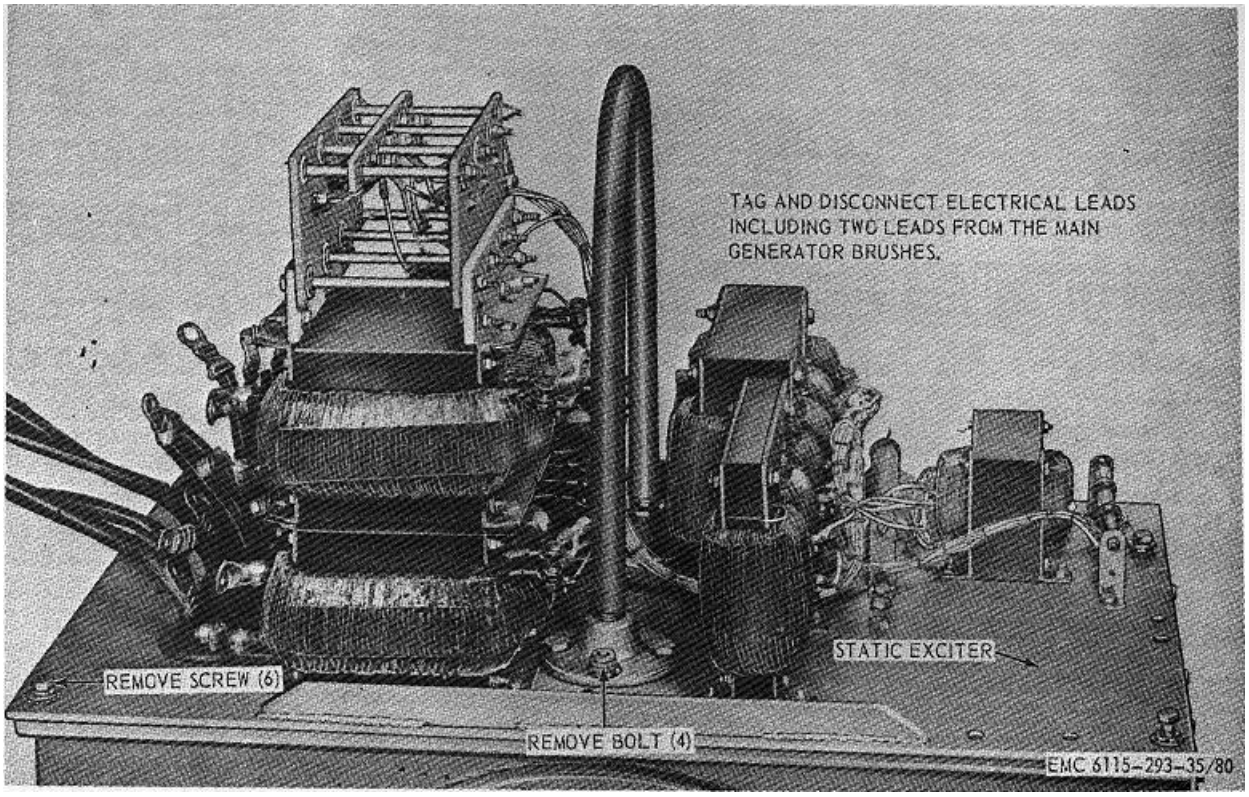


Figure 80. Static exciter, removal and installation.

(1) Clean, inspect, and repair.
(2) Tag and disconnect the electrical leads. Using a multimeter, measure the resistance across each diode rectifier. The forward-to-reverse resistance ratio must be 1 to 200 + 5 percent. Replace a defective diode rectifier.

f. Remove and install the choke coil as shown by figure 81.

(1) Clean and inspect.
(2) Tag and disconnect the electrical leads. Using a multimeter, test for continuity between the two electrical leads of the choke coil. If the choke coil fails to indicate continuity, replace the choke coil.
(3) Using a megohmmeter, test the insulation resistance between one electrical lead and the mounting clip. An indication of less than 0.4 megohm indicates a defective choke coil. Replace the choke coil.

g. Remove and install the current transformer as shown by figure 81.

(1) Clean and inspect.
(2) Tag and disconnect the electrical leads. Using a multimeter, test between electrical leads 24 and 22; continuity should be indicated. Test between electrical leads 24 and 23 and between 24 and 21. If continuity is not indicated, replace the current transformer.
(3) Using a megohmmeter, test the insulation resistance between one electrical lead and the mounting clip; an indication of less than 0.4 megohm indicates a defective current transformer.
(4) Test the two remaining current transformers in a similar manner. Replace a defective current transformer.

h. Remove and install the potential transformer as shown by figure 81.

(1) Clean and inspect.
(2) To test the primary windings, tag and disconnect the electrical leads. Using a multimeter, test between electrical leads T1A and T1; continuity must be indicated. Test for continuity between electrical leads

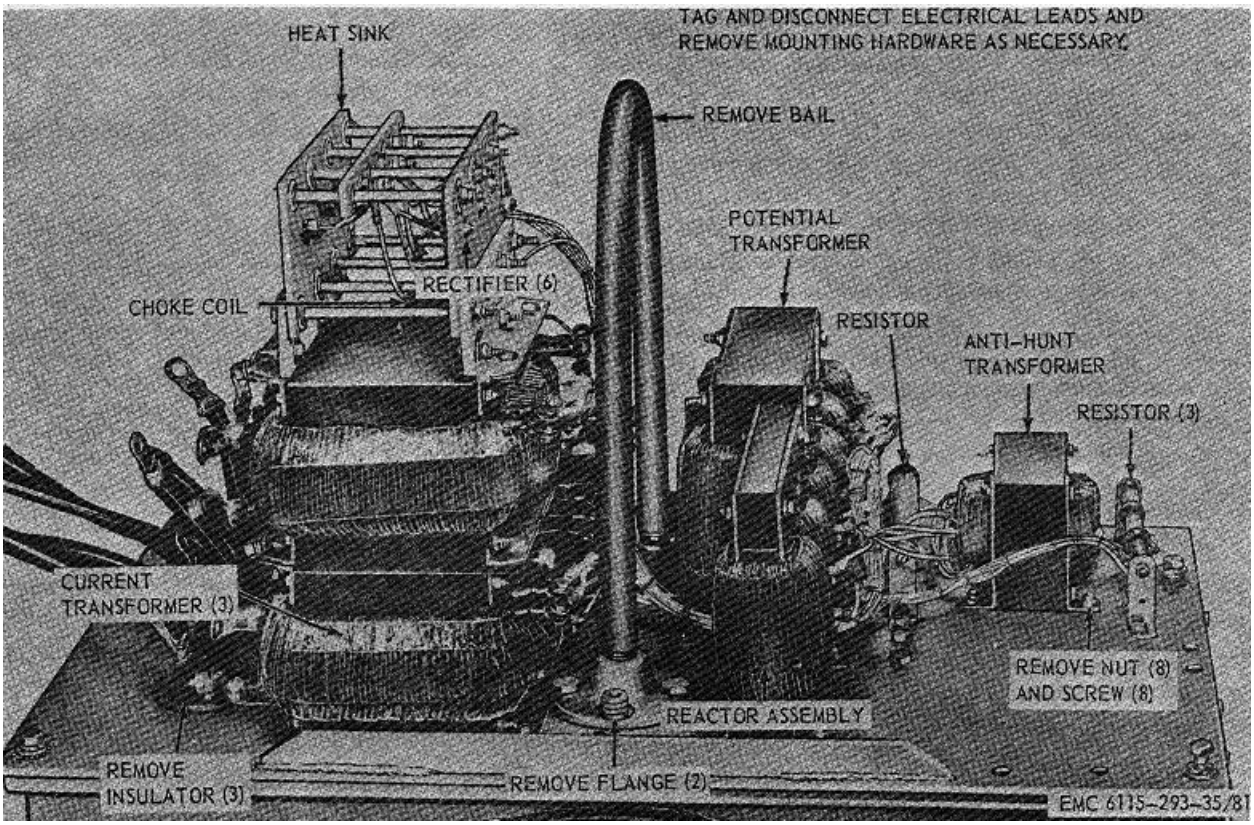


Figure 81. Heat sink, transformers, resistors, and choke, removal and installation.

T2A and T2, T3A and T3, T7A and T7, T8A and T8, and T9A and T9 in a similar manner.

(3) To test the secondary windings, tag and disconnect the electrical leads. Using a multimeter, test between electrical leads S4 and S3 of all five remaining pairs of secondary windings of the potential transformer. Continuity must be indicated between each pair of electrical leads.

(4) Using a megohmmeter, test the insulation resistance between the electrical lead T1A and transformer core. An indication of less than 0.4 megohm shows faulty insulation and the transformer must be replaced. Test between T2A and core, T3A and core, T7A and core, T8A and core, and T9A and core in a similar manner.

(5) Using a megohmmeter, test the insulation resistance between electrical lead S4 and core. An indication of 0.4 megohm shows defective insulation. Test the insulation resistance between the five remaining electrical leads marked S4 and the core and between S4 and T1A in a similar manner. Replace a faulty potential transformer.

i. Remove and install the antihunt transformer as shown by figure 81.

(1) Clean and inspect.

(2) Tag and disconnect the electrical leads. Using a multimeter, test between electrical leads P1 and P2; continuity must be indicated. Test for continuity between electrical leads S3 and S4 in a similar manner. Replace a defective transformer.

(3) Using a megohmmeter, test the insulation resistance between the electrical lead P1 and transformer core, between S3 and core, and P1 and S3. An indication of less than 0.4 megohm indicates defective insulation. Replace the defective antihunt transformer.

j. Remove and install the reactor assembly as shown by figure 81.

(1) Clean and inspect.

(2) Tag and disconnect the electrical leads. Using a multimeter, test between electrical leads S and F. Continuity must be indicated. Test the remaining pairs of electrical leads in a similar manner. Replace a defective reactor assembly.

(3) Using a megohmmeter, test the insulation resistance between electrical lead S and the reactor assembly core. An indication of less than 0.4 megohm indicates defective insulation and the reactor assembly must be replaced.

k. Remove and install the static exciter resistors as shown by figure 81.

(1) Clean and inspect.

(2) Tag and disconnect the electrical leads. Using a multimeter, test the resistors. Refer to figure 1 for their respective values. A tolerance of not more than 5 percent must be indicated. Replace a defective resistor.

Section III. GOVERNOR LOAD COMPUTER

135. General

The governor load computer is sealed by two lead seals. In conjunction with the governor, the system provides high control sensitivity, fast response, and minimum speed (frequency) deviations with load fluctuations. The electrical frequency sensing provided with this system is accomplished with static components and without the use of electronic tubes. The circuits within the governor load computer enable it to sense load changes immediately; and, as a result of high-frequency operation and consequent low time delays, is able to make throttle corrections in minimum time.

136. Governor Load Computer

a. Remove and install the governor load computer as shown by figure 82.

b. Clean and inspect.

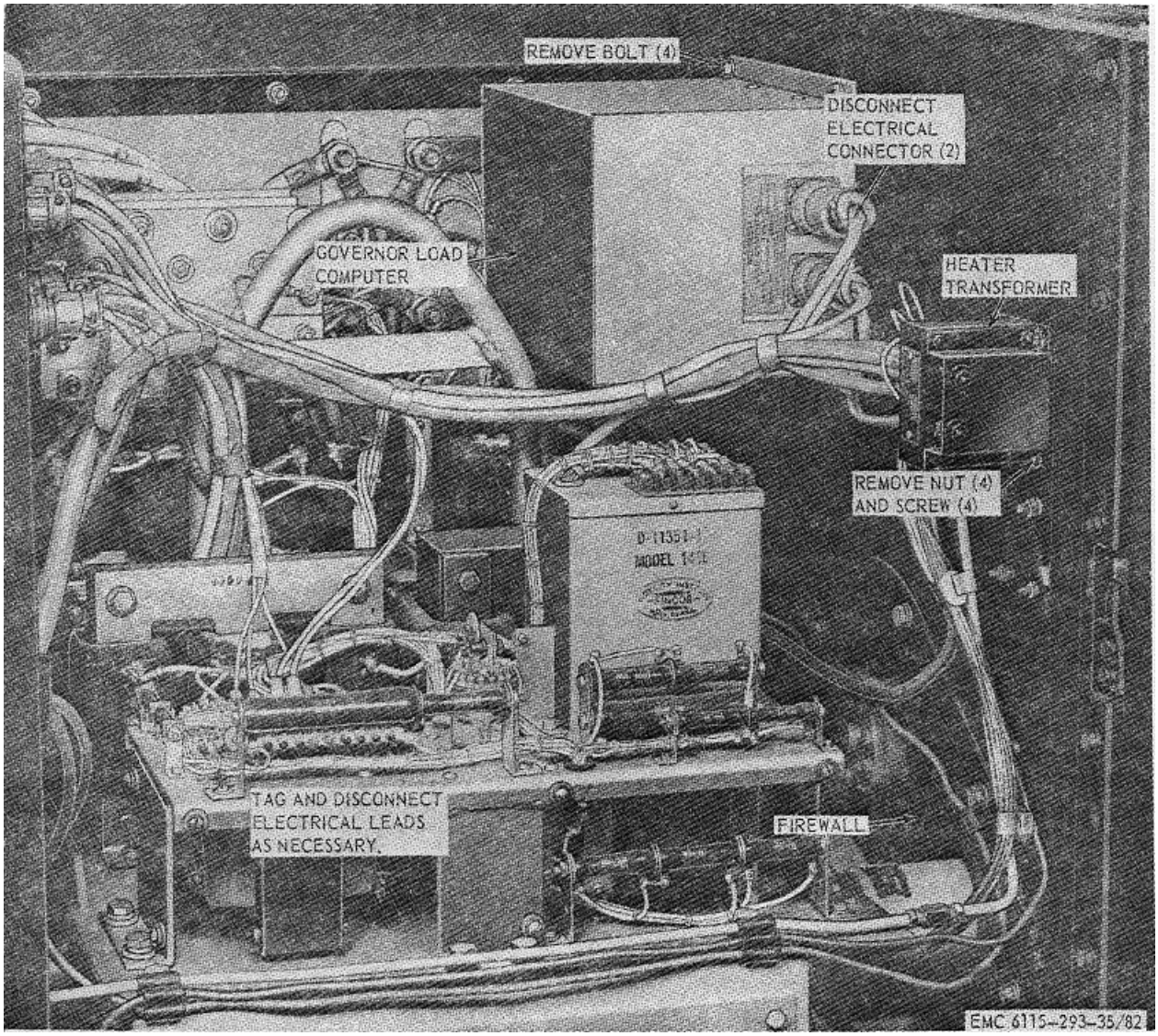


Figure 82. Governor load computer, removal and installation.

Section IV. MAIN GENERATOR

137. General

A four-pole, air-cooled, single-bearing generator (alternator) supplies the output power. The main generator rotor is coupled by means of the fan to the engine flywheel. Field current, induced by the exciter to the revolving field, enters through the electrical contact ring and voltage is induced in the stator windings. Output voltage is automatically controlled by the main generator regulator.

138. Main Generator

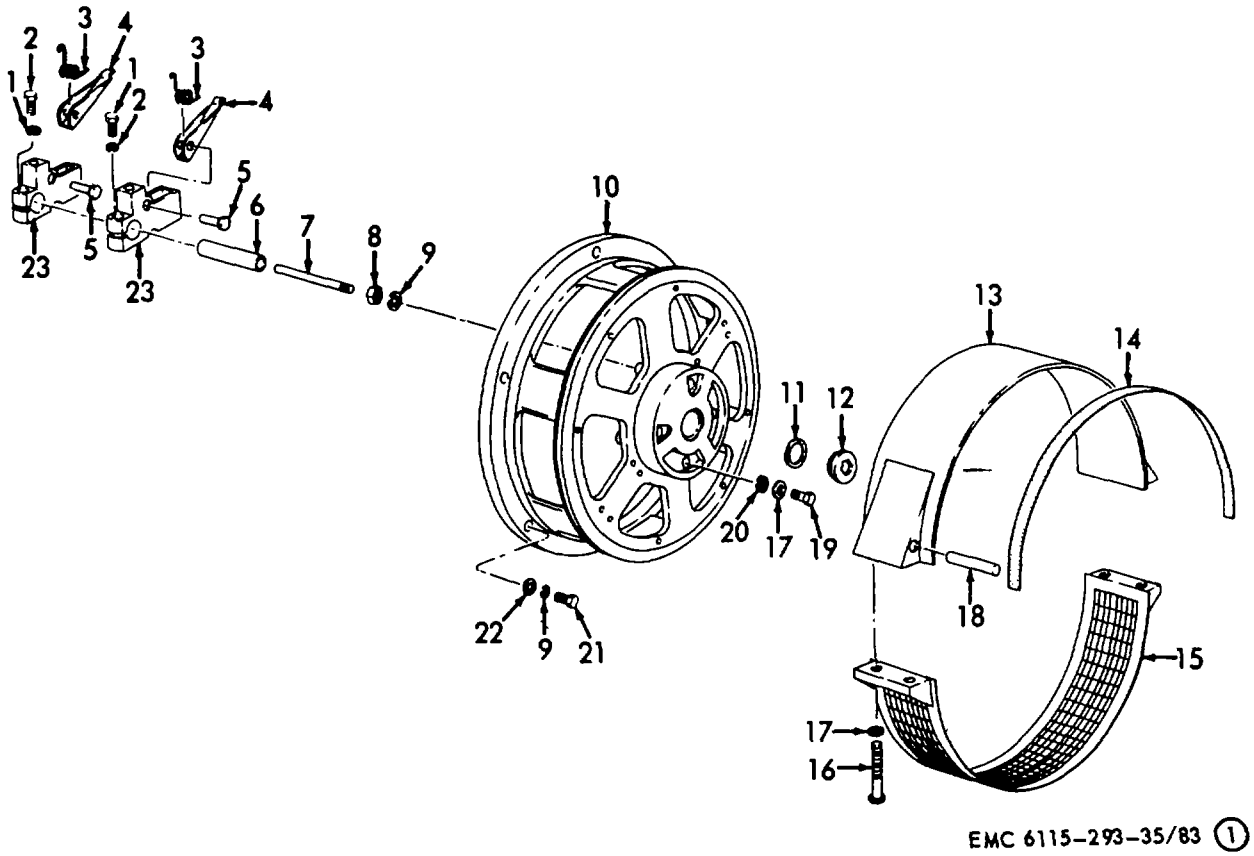
a. Refer to TM 5-764 for on-unit testing of the main generator.

b. Remove and install the main generator (par. 37).

c. Disassemble and reassemble the main generator as shown by figure 83.

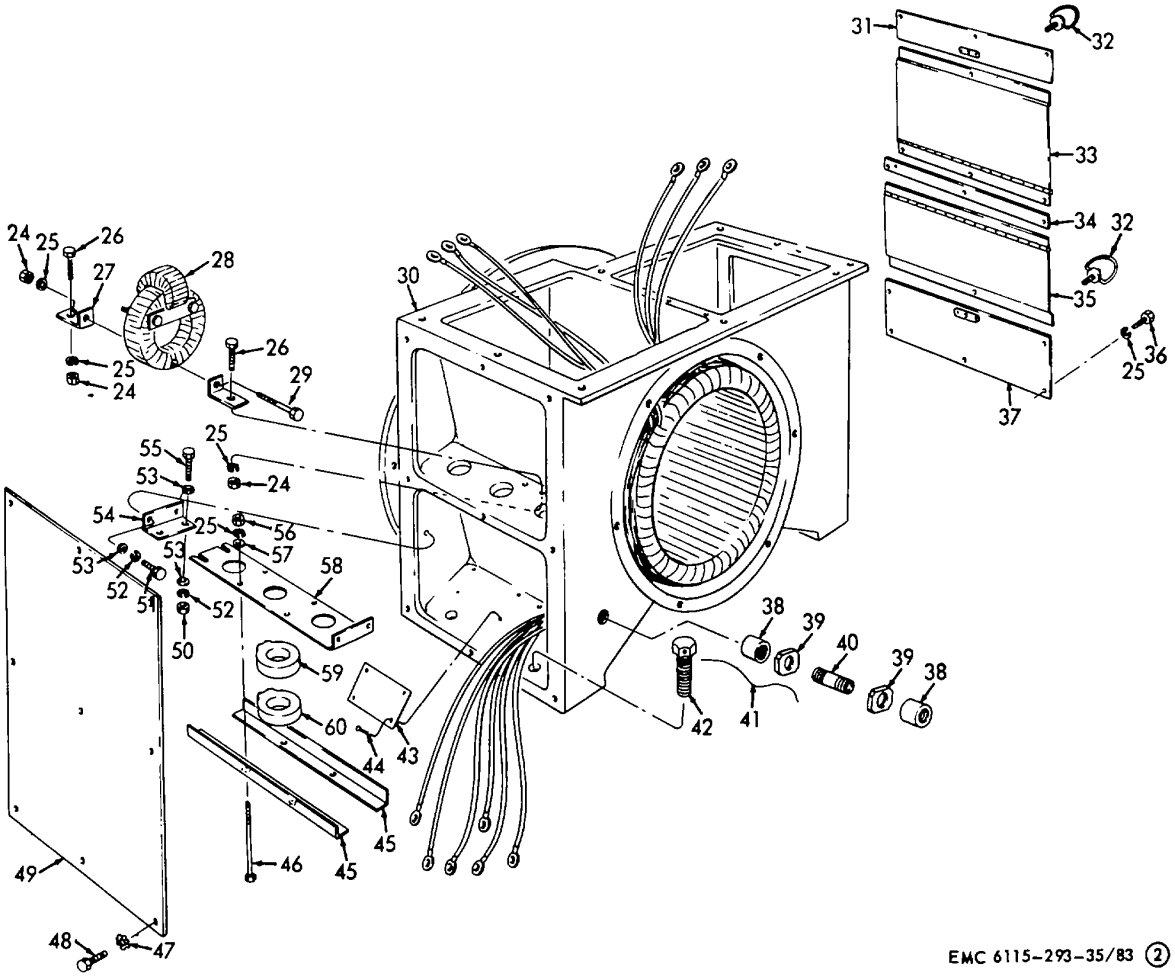
d. Clean, inspect, and repair.

e. Refer to TM 5-764 for after-disassembly testing.



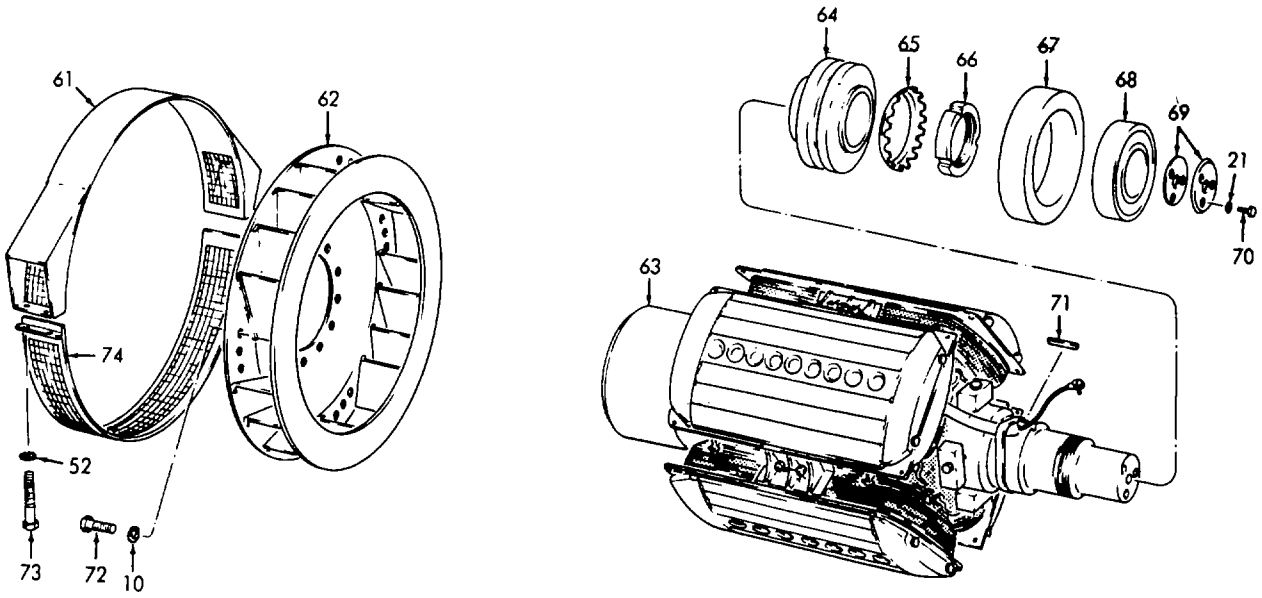
1	Washer, lock, No. 10 (12 rqr)	13	Top band cover
2	Screw, machine, No. 10-32 x 5/8 in. (8 rqr)	14	Band cover gasket (2 rqr)
3	Torsion helical spring (8 rqr)	15	Bottom band cover
4	Electrical brush arm (8 rqr)	16	Screw, machine, 3/8-16 x 3 in. (4 rqr)
5	Rivet, solid, brass, 3/16 x 3/4 in. (8 rqr)	17	Washer, flat, V in. 3/8 in. (8rqr)
6	Electrical insulator sleeving (4 rqr)	18	Cover screw retaining pin (2 rqr)
7	Brush holder stud (4 rqr)	19	Screw, cap, hex-hd, 3/8-16 x 1 1/2 in. (4 rqr)
8	Nut, plain, hex, 1/2-20 (4 rqr)	20	Washer, lock, 3/8 in. (7 rqr)
9	Washer, lock, 1/2 in. (18 rqr)	21	Screw, cap, hex-hd, 1/2-13 x 2 in.
10	Endbell frame	22	Was-her, flat,1/2 in. (6 rqr)
11	Nonmagnetic washer (spec)	23	Electrical contact brush holder (8 rqr)
12	Plug (spec)		

Figure 83. Main generator, disassembly and reassembly.



24	Nut, plain, hex, 1/4-20 (3 rqr)	43	Identification plate (2 rqr)
25	Washer, lock, 1/4 in. (15 rqr)	44	Screw, thd-forming, No. 10 (8 rqr)
26	Screw, cap, hex-hd, 1/4-20 x 1 in. (2 rqr)	45	Transformer retaining angle (2 rqr)
27	Transformer mounting bracket (2 rqr)	46	Screw, machine, No. 10-24 x 31/2 in. (4 rqr)
28	Crosscurrent transformer	47	Washer, lock, IET, 1/4 in. (9 rqr)
29	Screw, cap, hex-hd, 1/4-20 x 134 in.	48	Screw, machine, 1/4-20 x 5/8 in. (9 rqr)
30	Generator stator	49	Transformer access plate
31	Hose compartment plate	50	Nut, plain, hex, 5/16-18 (4 rqr)
32	Door fastener (2 rqr)	51	Bolt, machine, 5/16-18 x 7/8 in. (4 rqr)
33	Stator door	52	Washer, lock, 5/16 in. (10 rqr)
34	Hinge spacer	53	Washer, flat, 5/16 in. (6 rqr)
35	Stator door	54	Bracket support
36	Screw, cap, hex-hd, 4-20 x Y2 in. (12 rqr)	55	Bolt, machine, 5/16-18 x 1 in. (2 rqr)
37	Plate	56	Nut, plain, hex, No. 10-24 (4 rqr)
38	Lead insulator bushing (2 rqr)	57	Washer, flat, No. 10 (4 rqr)
39	Lockring (2 rqr)	58	Transformer mounting bracket
40	Nipple (spec)	59	Current transformer (500/1) (3 rqr)
41	Lockwire (2 rqr)	60	Current transformer (435/5) (3 rqr)
42	Generator mounting bolt (spec) (4 rqr)		

Figure 83. Main generator, disassembly and reassembly-Continued.



61	Top cover band	68	Ball bearing
62	Rotating electrical fan	69	Washer (spec) (2 rqr)
63	Rotor	70	Screw, cap, hex-hd, 3/8-16 x 1 in. (3 rqr)
64	Collector ring assembly	71	Key (spec)
65	Lockwasher (spec)	72	Screw, cap, hex-hd, 1/2-13 x 1 1/4 in. (8 rqr)
66	Self-locking nut (spec)	73	Screw, cap, hex-hd, 5/16-18 x 1 7/8 in. (4 rqr)
67	Bearing housing	74	Bottom cover band

Figure 83. Main generator, disassembly and reassembly-Continued.

Section V. GOVERNOR LOAD SENSING RESISTOR

139. General

The governor load sensing resistor is located on the firewall near the terminal block. The resistor produces a voltage drop which is proportional to the current flow through the three governor current transformers. This voltage is fed to the governor computer which, in turn, electrically controls the governor.

140. Governor Load Sensing Resistor

a. Remove and install the governor load sensing resistor as shown by figure 84.

b. Test the resistors with a multimeter. The correct value is 5 ohms. Replace as an assembly if defective.

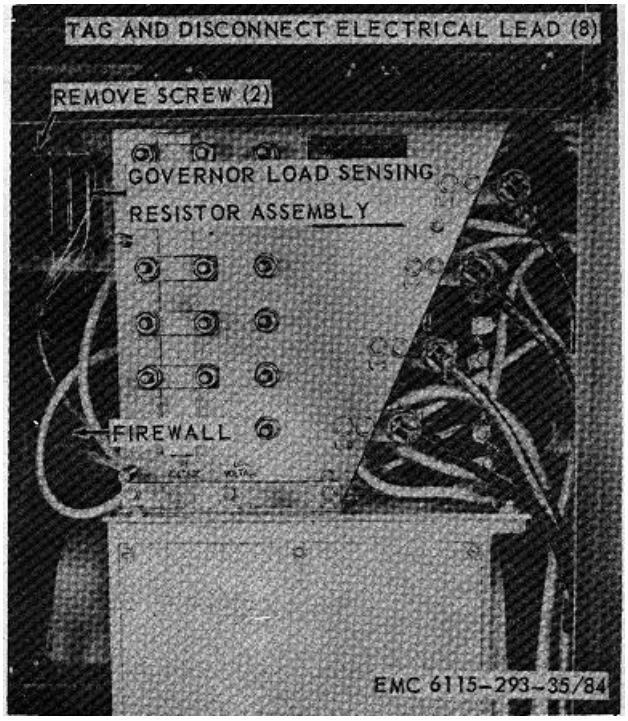


Figure 84. Governor load sensing resistor, removal and installation

Section I. COOLANT HEATER AND FUEL TANK

141. General

The gasoline-burning coolant heater preheats the diesel engine by heating the engine coolant, which circulates through the heat exchanger water jacket of the heater. For the schematic of the cooling system, refer to figure 85. The coolant heater exhaust warms the battery box. A blower unit supplies air to the combustion chamber and a control housing contains the fuel and electrical controls. The fuel tank is located under the coolant heater.

142. Coolant Heater

a. Remove and install the radiator and hood support (par. 39).

b. Remove and install the coolant heater as shown by figure 86.

c. Disassemble and reassemble the coolant heater as shown by figures 87, 88, and 89.

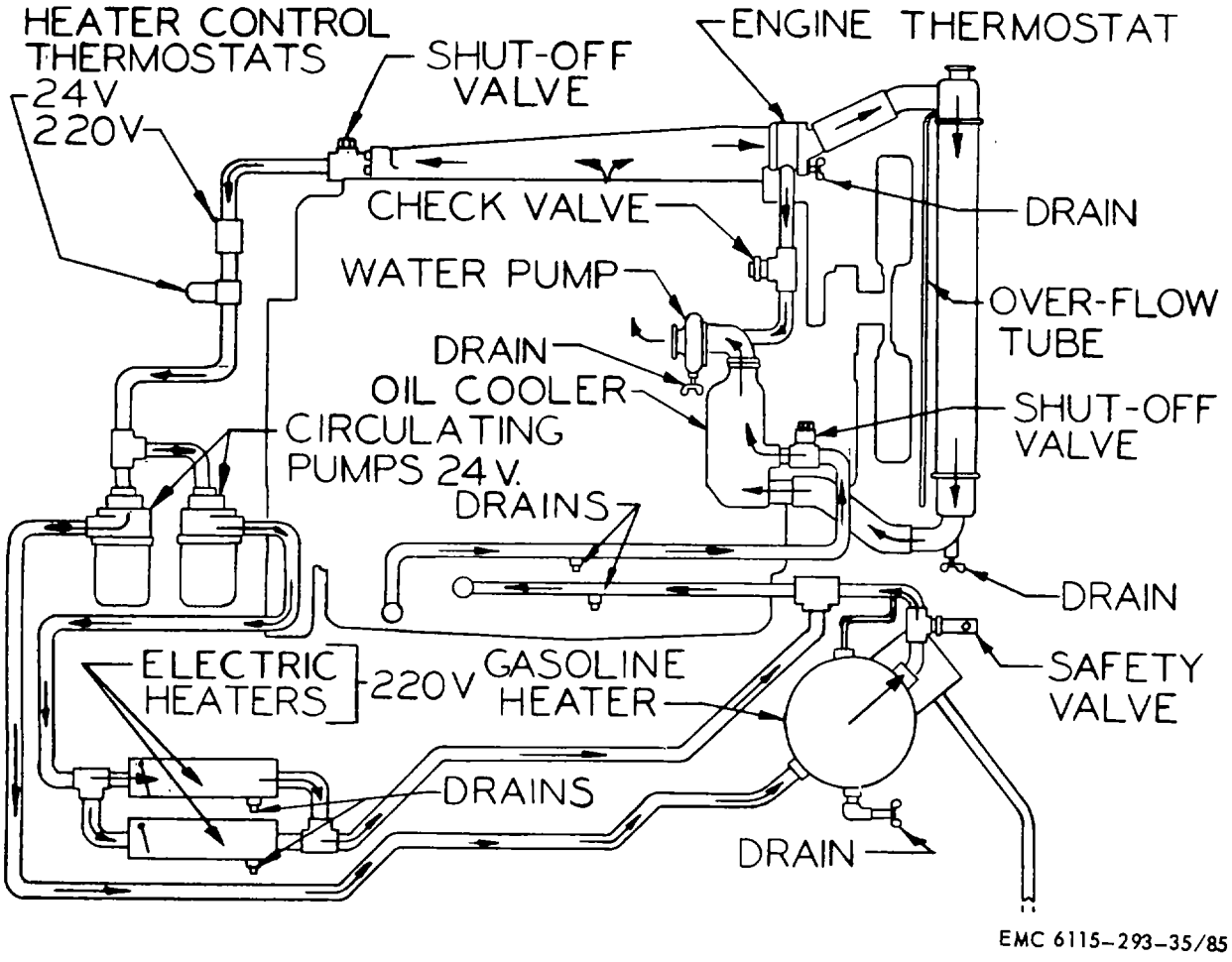


Figure 85. Coolant flow diagram.

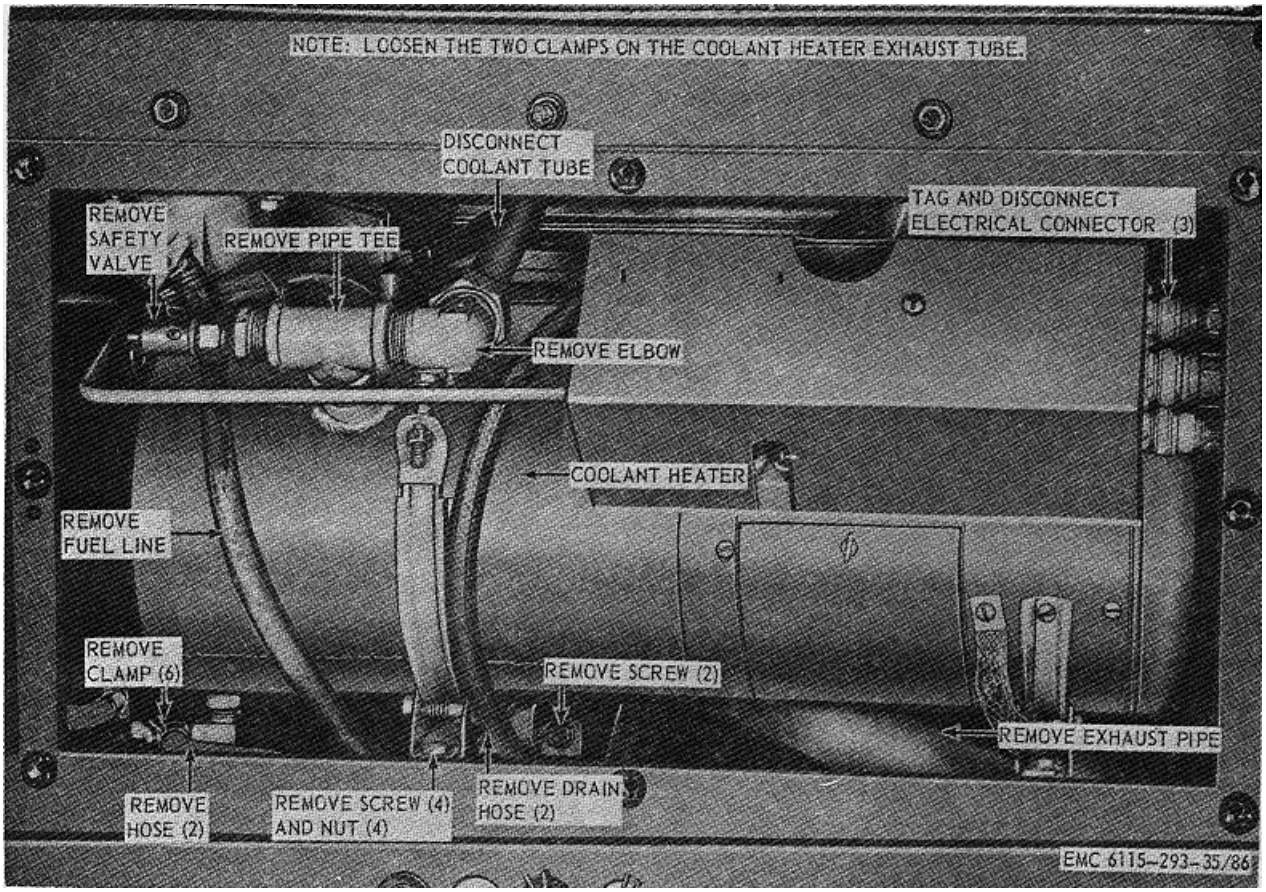


Figure 86. Coolant heater, removal and installation.

d. Clean, inspect, and repair.

e. Perform the bench test as follows:

(1) *Operating test.*

(a) Install the coolant heater on a test stand equipped to operate the unit and measure voltage, amperage, and fuel flow.

(b) Turn the test stand voltage selector switch to 24 volts.

(c) Turn on the test stand fuel pump.

(d) Place the test stand heater switch to the high heat position.

(e) The blower should start immediately and the ammeter should indicate 15 amperes.

(f) After an interval of 45 seconds maximum, the flame switch should transfer, the blower should speed up, and the amperage should drop to 3 amperes. The indicator lamp should light when the flame switch transfers.

(g) Place the test stand heater switch to the OFF position.

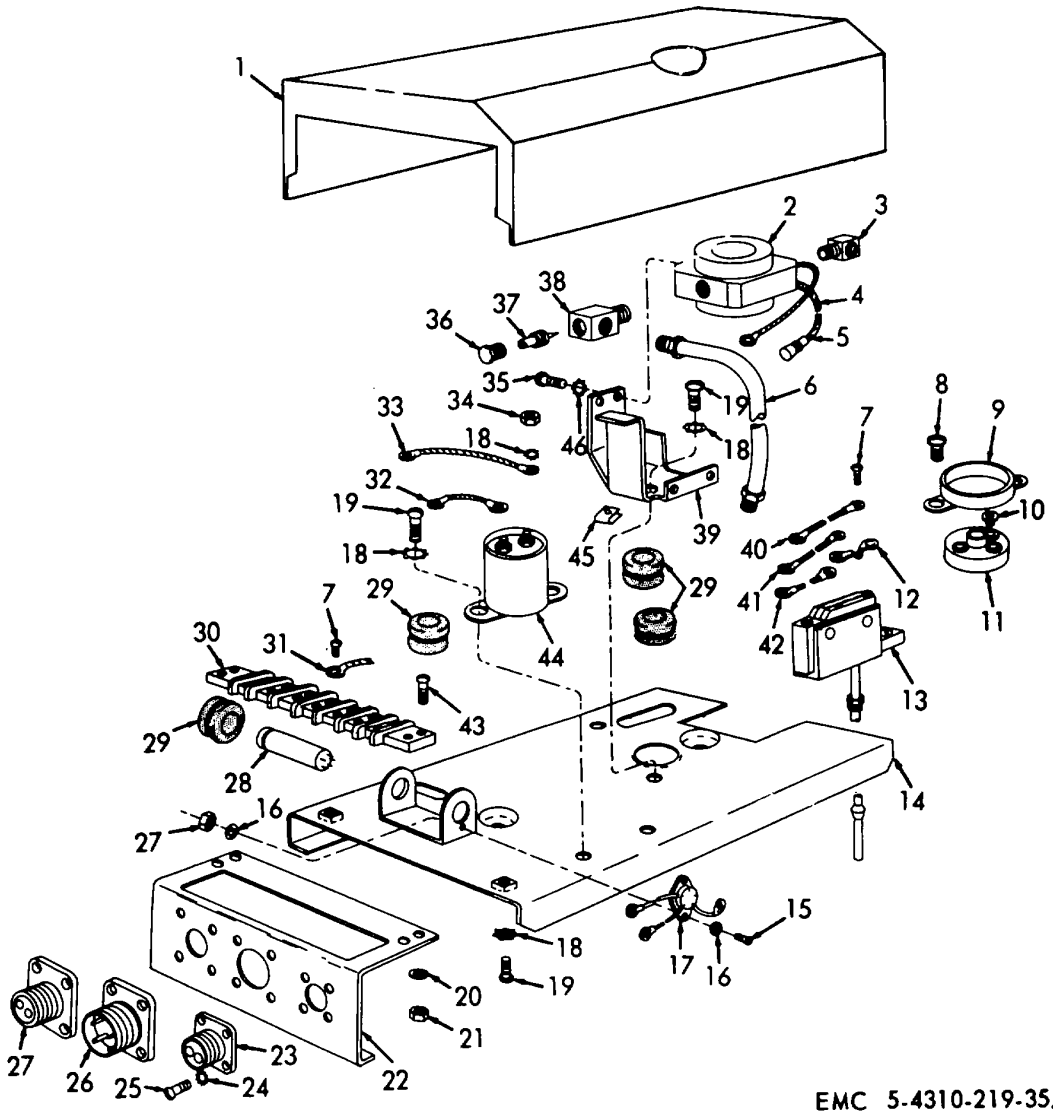
(h) The burner should go off within 45 seconds, but the blower should continue to operate approximately 2 minutes to purge and cool the heater. The indicator lamp should continue to burn during this interval and should go out when the flame switch transfers and stops the blower.

(i) If the coolant heater fails to operate as described above, replace defective parts.

(2) *Fuel control valve test.*

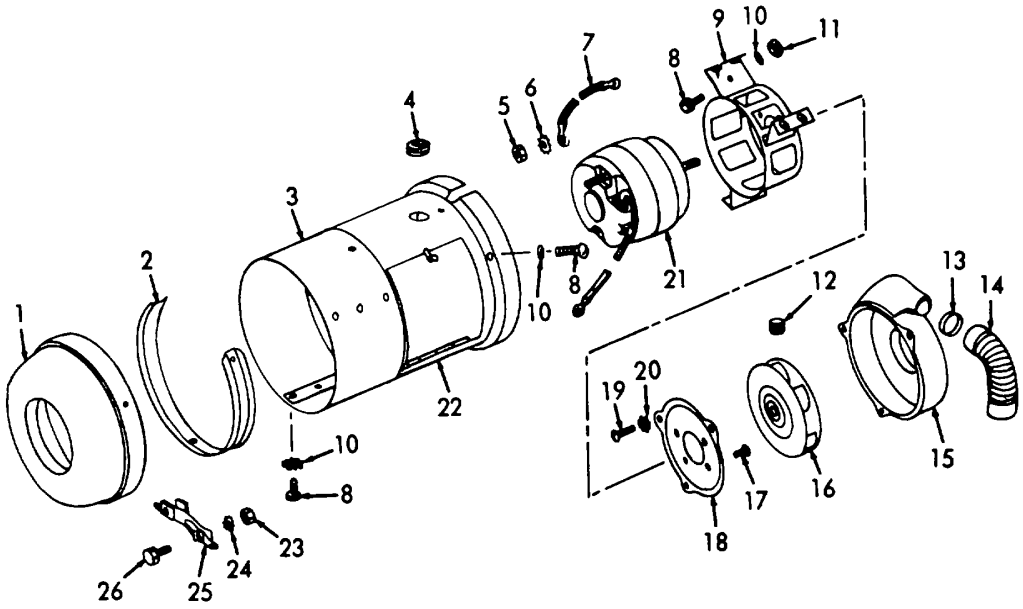
(a) With the coolant heater connected as in (1) above, and with the test stand heater switch in the OFF position, turn on the test stand fuel pump.

(b) Turn the test stand fuel flow meter control valve to ON. When the fuel flow meter is full, close the fuel flow meter control valve.



1 Cover
2 Fuel regulator
3 Elbow
4 Fuel shutoff valve lead
5 Pressure regulator lead connector
6 Fuel line
7 Screw, brass, No. 6-32 x 1/4 in. (19 rqr)
8 Screw, machine, No. 8-32 x1/4 in. (2 rqr)
9 Retainer
10 Screw (spec) (2 rqr)
11 Limit switch
12 Jumper
13 Flame switch
14 Housing frame
15 Screw, brass, No. 4-40 x 3/8 in. (2 rqr)
16 Washer, lock, IT, 1/4 in. (4 rqr)
17 Socket
18 Washer, lock, ET, No, 10 (7 rqr)
19 Screw, machine, No. 10-32 x 5/16 in. (5 rqr)
20 Washer, lock, IT, No. 8 (4 rqr)
21 Nut, plain, hex, No. 8-32 (4 rqr)
22 Bracket
23 Connector (2 rqr)
24 Washer, lock, ET, No. 4 (12 rqr)
25 Screw, self-tapping, No. 4-40 x 5/16 in. (12 rqr)
26 Connector
27 Nut, brass, No. 4-40 (2 rqr)
28 Thermal relay
29 Grommet (4 rqr)
30 Terminal block
31 Wire lead
32 Jumper
33 Igniter lead
34 Nut, plain, hex, No. 10-24 (2 rqr)
35 Screw, machine, No. 8-32 x 3/8 in. (2 rqr)
36 Plug (spec)
37 Inner nozzle
38 Fitting
39 Bracket
40 Wire lead
41 Wire lead
42 Wire lead
43 Screw, brass, No. 8-32 x 5/8 in. (4 rqr)
44 Resistor
45 Speed nut
46 Washer, lock, ET, No. 8 (2 rqr)

Figure 87. Coolant heater controls housing, disassembly and reassembly.



1	Cover	14	Flexible hose
2	Mounting ring	15	Scroll housing
8	Housing	16	Fan
4	Grommet	17	Screw, machine, No. 8-32 x 1/2 in. (4 rqr)
5	Nut, plain, hex, No. 8-32	18	Scroll cover
6	Washer, lock, ET, No. 8	19	Screw, machine, No. 6-32 x 5/16 in. (3 rqr)
7	Ground lead	20	Washer, lock, ET, No. 6 (3 rqr)
8	Screw, cap, No. 10-32 x 5/16 in. (13 rqr)	21	Blower motor
9	Motor support bracket	22	Side door
10	Washer, lock, ET, No. 10 (13 rqr)	23	Nut, plain, hex, 5/16-18 (2 rqr)
11	Nut, plain, hex, No. 10-32	24	Washer, lock, ET, 5/16 in. (2 rqr)
12	Setscrew, No. 10-32 x 3/16 in.	25	Mounting bracket
13	Hose clamp (2 rqr)	26	Bolt, hex-hd, 5/16-18 x 1 1/2 in. (2 rqr)

Figure 88. Coolant heater blower, disassembly and reassembly.

(c) Observe the level of gasoline in the fuel flow meter. If it is dropping, the heater fuel control valve is defective. Replace a defective fuel control valve.

(d) Turn the fuel flow meter control valve to ON.

(e) Turn the test stand heater switch to high-heat position.

(f) After the heater is started and operating normally, turn the fuel flow meter control valve to the OFF position.

(g) With a stop watch, measure the time required for the fuel level in the fuel flow meter to drop from the FULL mark to the EMPTY mark.

(h) From the table furnished with the test stand, compute the fuel consumption. It should be 43 to 52 cubic centimeters per minute.

(i) With the test stand heater switch in the low-heat position, repeat steps (f) through (h) above. The fuel consumption for low-heat operation should be 29 to 35 cubic centimeters per minute.

(j) Turn off the coolant heater. Replace a defective fuel control valve.

(k) Remove the coolant heater from the test stand.

143. Coolant Heater Fuel Tank

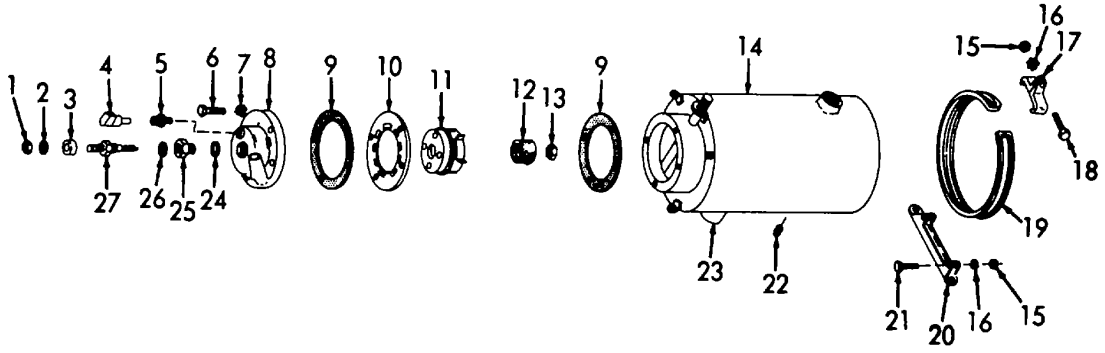
a. Remove and install the coolant heater (par. 142).

b. Remove and install the coolant heater fuel tank as shown by figure 90.

c. Clean, inspect, and repair.

Warning

Fill the fuel tank with water and flush several times before soldering or brazing. Failure to observe this warning may result in the tank exploding and causing serious injury to personnel.



1	Nut, plain, hex, No. 10-24 (2 rqr)	15	Nut, plain, hex, 5/16-18 (3 rqr)
2	Washer, flat, No. 10	16	Washer, lock, ET, 5/16 in. (3 rqr)
3	Gasket	17	Ring clamp
4	Elbow	18	Bolt, hex-hd, 5/16-18 x 1 3/4 in.
5	Generator nozzle	19	Mounting ring
6	Screw, cap, No. 10-32 x 9/16 in. (4 rqr)	20	Mounting clamp
7	Washer, lock, ET, No. 10 (4 rqr)	21	Bolt, hex-hd, 5/16-18 x 1 1/2 in. (2 rqr)
8	Burner head	22	Plug, pipe, 1/8 in.
9	Gasket (2 rqr)	23	Exhaust outlet
10	Mixing ring	24	Sleeve gasket
11	Generator	25	Sleeve
12	Wick	26	Gasket
13	Retainer nut	27	Igniter
14	Combustion chamber		

Figure 89. Coolant heater burner and combustion chamber, disassembly and reassembly.

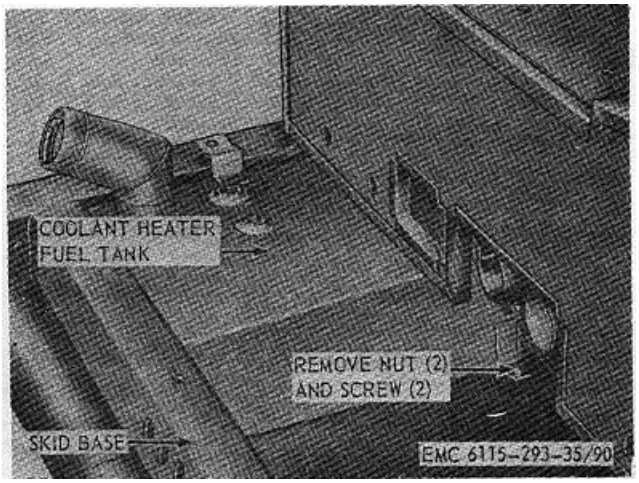


Figure 90. Coolant heater fuel tank, removal and installation.

Section II. COOLANT HEATER EXHAUST TUBE

144. General

The coolant heater exhaust tube is a corrugated, stainless-steel tube which conducts the coolant heater exhaust gases to heat the battery box.

145. Coolant Heater Exhaust Tube

a. Remove and install the batteries (TM 56115-293-12).

b. Remove and install the coolant heater (par. 142).

c. Remove and install the exhaust tube as shown by figure 91.

d. Clean and inspect.

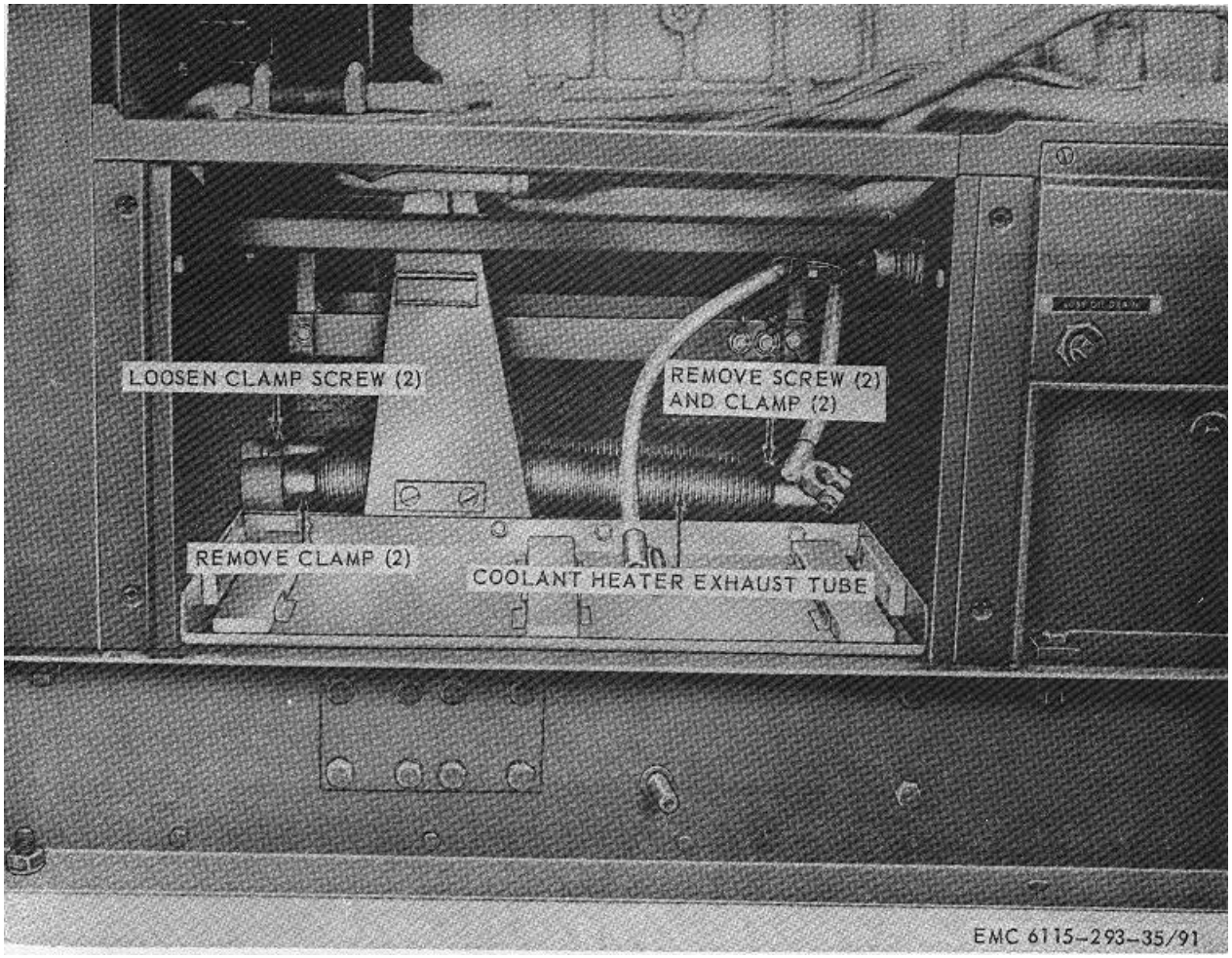


Figure 91. Exhaust tube, removal and installation.

Section III. CIRCULATING PUMPS AND TUBES

146. General

Two 24-volt electrical circulating pumps are provided in the winterization system. One circulating pump circulates the coolant through the heat exchanger of the gasoline coolant heater, oil pan, engine oil cooler, and engine block and then forces it back to the circulating pump. The other circulating pump circulates the coolant through the two 220-volt electrical heaters, the oil pan, the engine oil cooler, and the engine block and then forces it back to the circulating pump.

147. Circulating Pumps and Tubes

a. Remove and install the coolant tube hose connections (TM 5-6115-293-12).

b. Remove and install the radiator and hood support (par. 39).

c. Remove and install the circulating pumps and tubes as shown by figure 92.

d. Disassemble and reassemble the circulating pumps as shown by figure 93.

e. Clean, inspect, and repair.

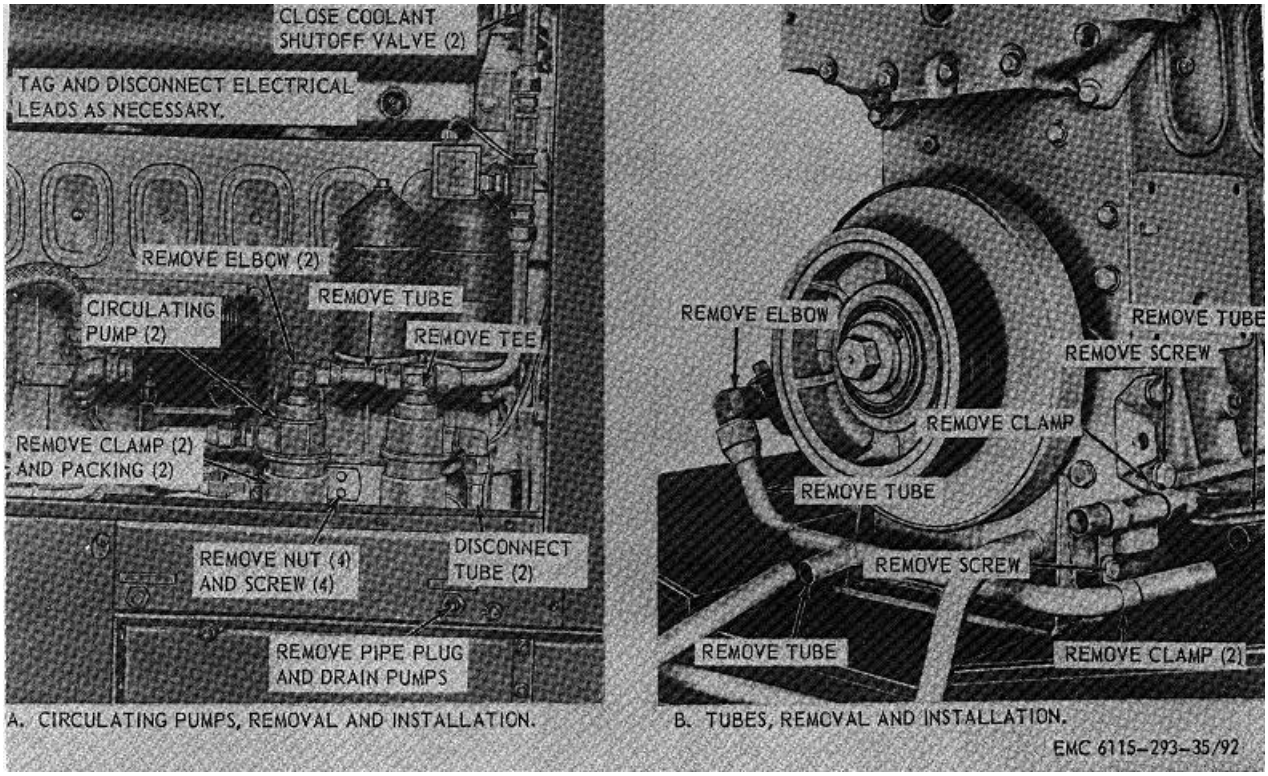
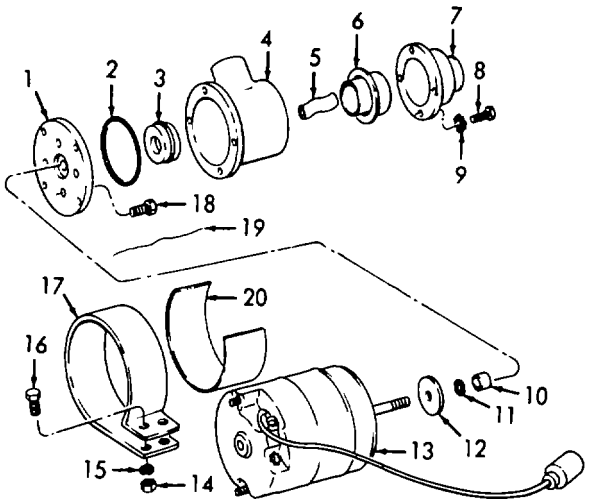


Figure 92. Circulating pumps and tubes, removal and installation.



1	Motor-to-discharge housing adapter	11	O-ring
2	O-ring	12	Pump shaft gasket
3	Seal	13	Motor
4	Discharge housing	14	Nut, plain, hex, 3/8-16 (2 rqr)
5	Rotor	15	Washer, lock, 3/8 in. (2 rqr)
6	Stator	16	Screw, cap, hex-hd, 3/8-16 x 1 in. (2 rqr)
7	Suction housing	17	Pump mounting clamp
8	Screw, machine, No. 10-24 x 1/2 in. (4 rqr)	18	Screw, fil-hd, drilled, No. 10-24 x 1/2 in. (4 rqr)
9	Washer, ET, No. 10 (4 rqr)	19	Lockwire
10	Bushing (spec)	20	Clamp-to-pump packing

Figure 93. Circulating pump, disassembly and reassembly.

Section IV. ELECTRIC COOLANT HEATERS

148. General

Two 220-volt electrical coolant heaters are provided to heat the coolant before starting or to maintain engine temperatures during shutdown periods. Power for the electric coolant heaters must be obtained from a source outside the generator set.

149. Electric Coolant Heaters

a. Remove and install the left side panel (TM 5-6115-293-12).

b. Remove and install the two circulating pumps (par. 147).

c. Remove and install the electric coolant heaters as shown by figure 94.

d. Using a multimeter, test between the terminals of the heater element for continuity. If continuity is not indicated, replace the heater element. Using a meoghmeter, test between one terminal of the heater element and heater body. A reading of not less than 0.25 megohm must be indicated. If not, replace the heater element.

e. Disassemble and reassemble the electric coolant heaters as shown by figure 95.

f. Clean, inspect, and repair.

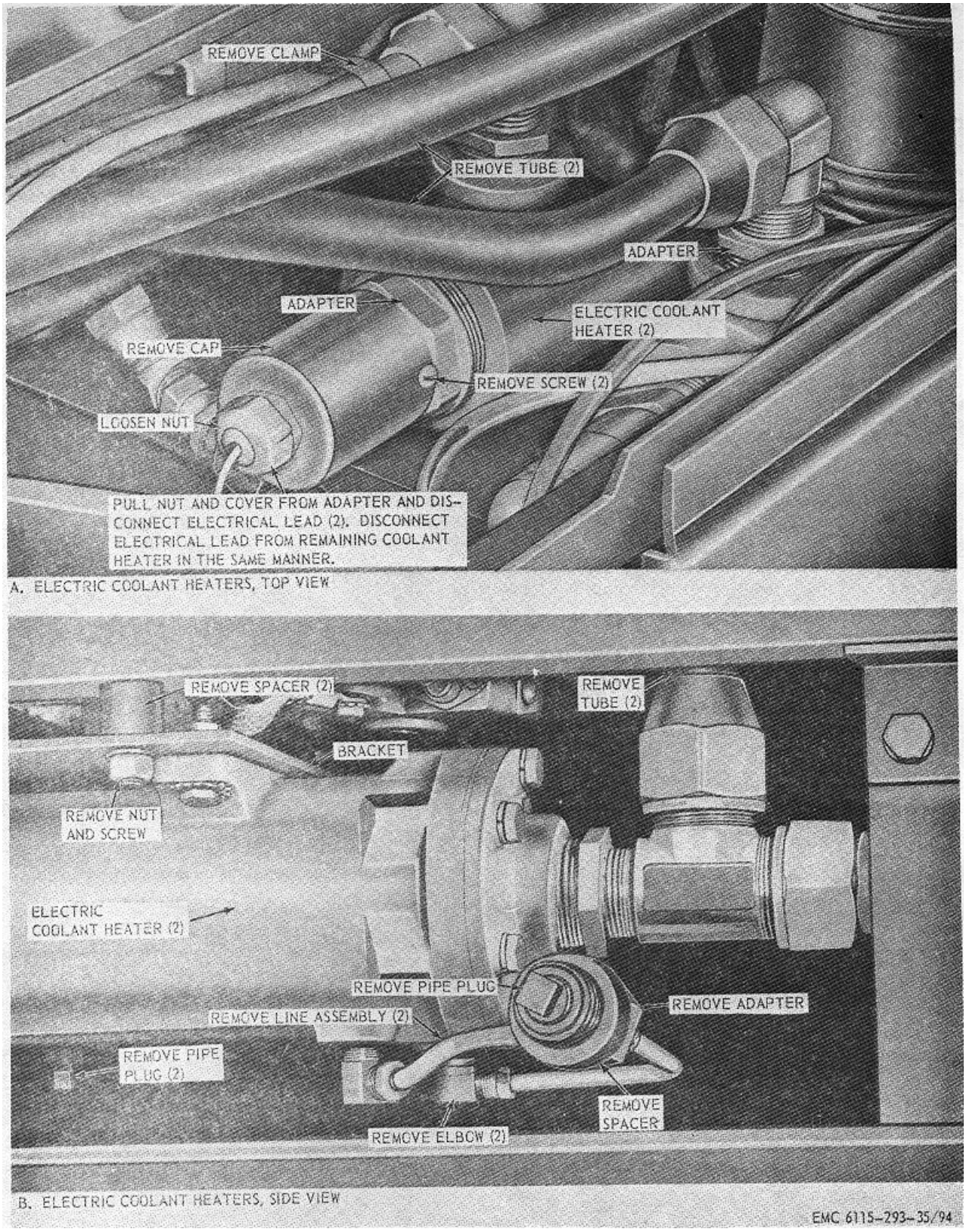
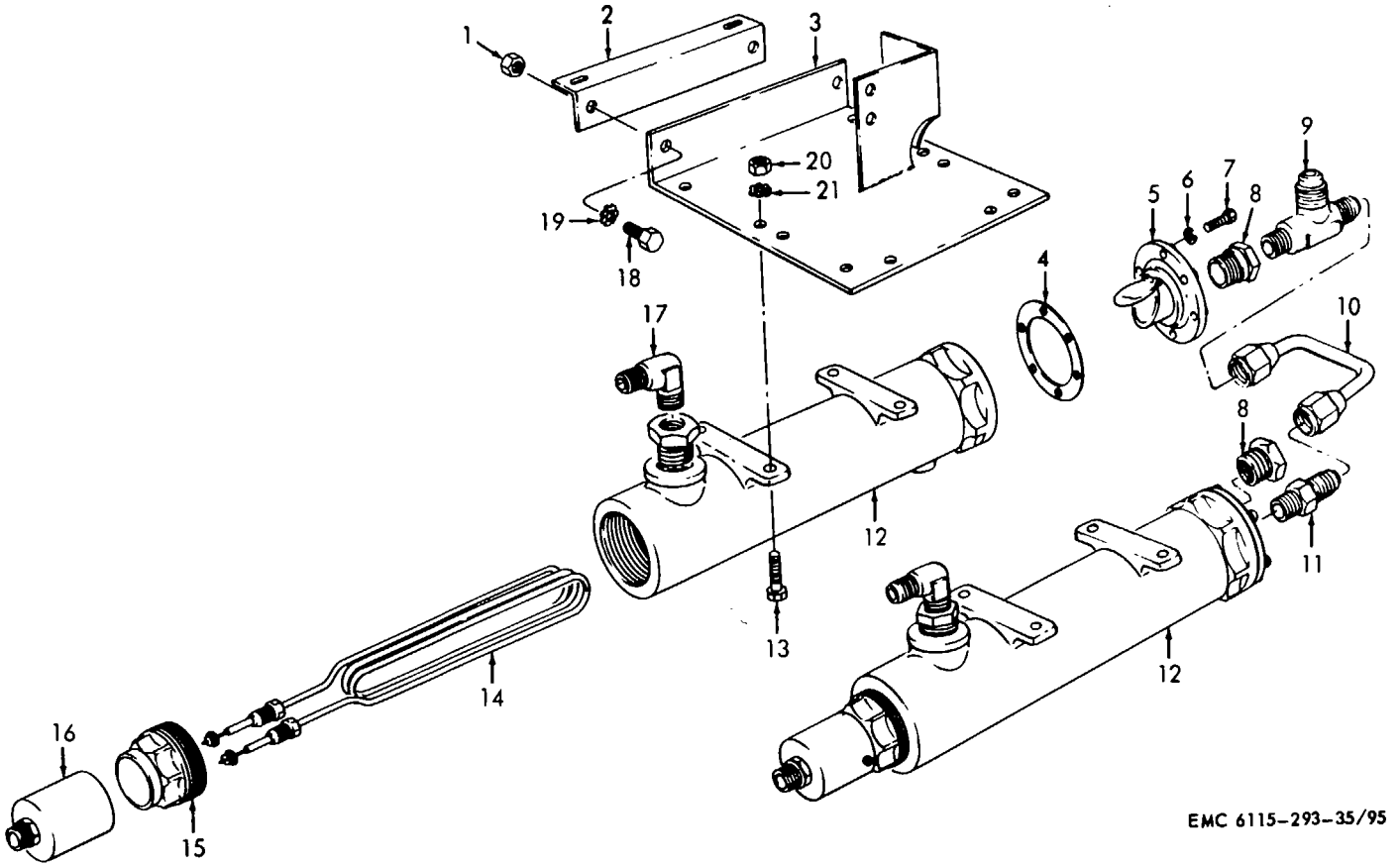


Figure 94. Electric coolant heaters, removal and installation.



1	Nut, plain, hex, 5/16-18 x 7/8 in. (2 rqr)	12	Heater body (2 rqr)
2	Bracket	13	Screw, cap, hex-hd, 4-20 x 1 in. (8 rqr)
3	Pump and heater bracket	14	Heater element (2 rqr)
4	Gasket (2 rqr)	15	Heater element adapter (2 rqr)
5	End cover (2 rqr)	16	Electric heater cover (2 rqr)
6	Washer, lock, 1/4 in. (12 rqr)	17	Elbow (2 rqr)
7	Screw, cap, hex-hd, 1/4-20 x 3/4 in. (12 rqr)	18	Bolt, machine, hex-hd, 5/16-18 (2 rqr)
8	Bushing, 7/8 in. pipe-to- 1 1/8 in. pipe	19	Washer, lock, IET, 5/16 in. (2 rqr)
9	Tee, 3/4 tube, 2 ends, 7/8 in. pipe, 3rd end	20	Nut, plain, hex, 1/4-20 (8 rqr)
10	Tube assembly	21	Washer, lock, IET, 1/4 in. (8 rqr)
11	Adapter, 3/4 tube-to-a 7/8 in. pipe		

Figure 95. Electric coolant heaters and brackets, disassembly and reassembly.

Section V. HEATER RELAY AND HEATER TRANSFORMER

150. General

The heater relay, along with the 220-volt thermostat, controls the electric coolant heaters. The heater transformer and its two -diodes step down and rectify the 208-volt ac input to a 24-volt dc output. This output voltage is used to operate the coolant circulating pump motors.

151. Heater Relay

a. Remove and install the heater relay as shown by figure 96.

b. Clean and inspect.

c. Tag and disconnect the electrical leads. Using a multimeter, test between the terminals of the heater relay coil for continuity. If continuity is not indicated, replace the heater relay. Inspect the condition of the relay contacts. The contact arms must operate freely and the contacts close squarely. If the relay does not meet these conditions, replace it.

152. Heater Transformer

a. Remove and install the heater transformer as shown by figure 81.

b. Clean and inspect.

c. Tag and disconnect the electrical leads. Using a megohmmeter, test the insulation resistance between electrical lead 147 and the mounting bracket. An indication of less than 0.25 megohm indicates a defective heater transformer. Connect a 75-watt, 8-ohm resistor between electrical lead 161 and the mounting bracket. Connect an external source of 60-cycles, 208 volts to terminals 147 and 148. Using a 0-50-volt, dc voltmeter, test across the 8-ohm resistor. A reading of 24-volt, dc, ± 5 percent, must be indicated. Replace a defective heater transformer.

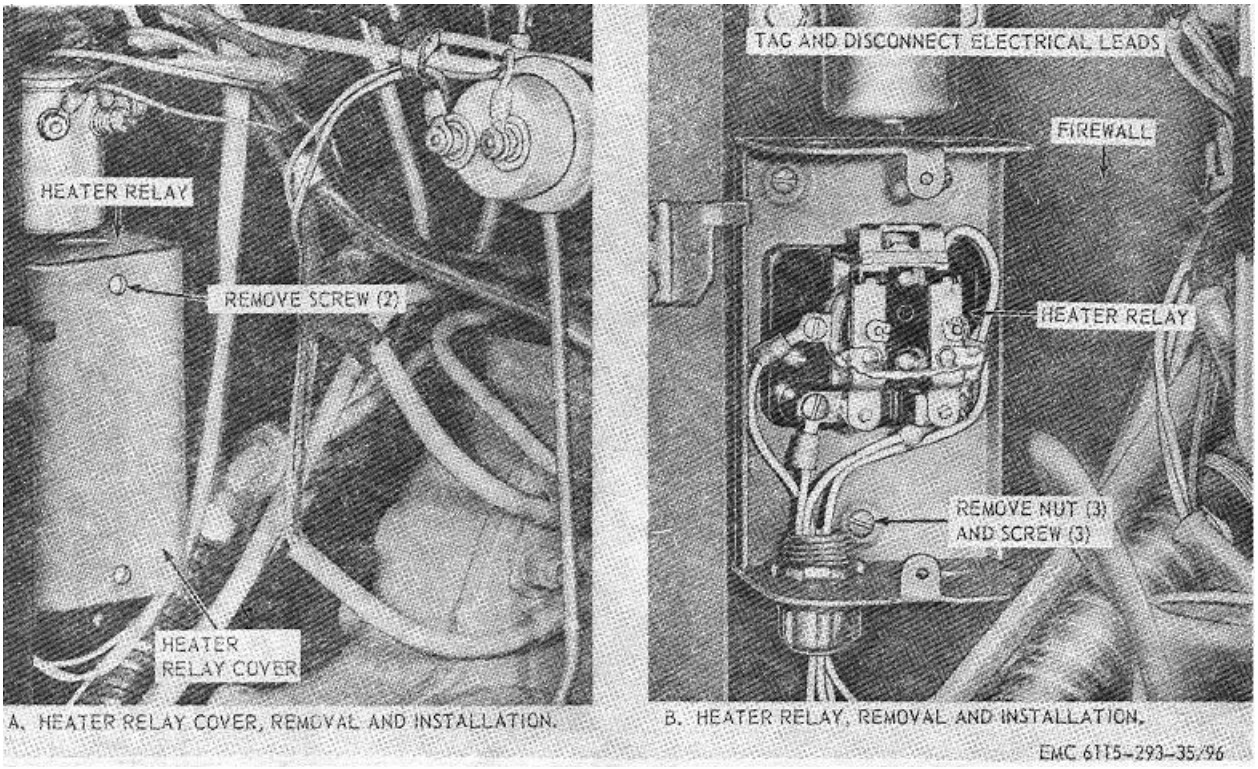


Figure 96. Heater relay, removal and installation.

APPENDIX
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1. Dictionaries of Terms and Abbreviations

AR 320-5	Dictionary of United States Army Terms.
AR 320-50	Authorized Abbreviations and Brevity Codes.

2. Field Maintenance

TM 5-764	Electric Motor and Generator Repair.

3. Fire Protection

TM 5-687	Repair and Utilities: Fire Protection Equipment and Appliances; Inspections, Operations, and Preventive Maintenance
TM 9-1799	Ordnance Maintenance: Fire Extinguishers.

4. Lubrication

LO 5-6115-293-12	Generator Set, Diesel Engine: Precise Power; 100 Kw, Ac, 120/208 V, 60 Cycle, 240/416 V, 50 Cycle; Skid Mounted (Detroit Diesel Divn. General Motors Corp. Mdl. 6910A) W/General Motors Engine Model 6910A, Series 6-71.

5. Operator and Organizational Maintenance Manual

TM 5-6115-293-12	Generator Set, Diesel Engine: Precise Power; 100 Kw, Ac, 120/208 V, 240/416 V, 3 Phase, 60 Cycle, at 1800 Rpm, 833 Kw, 120/208 V, 240/416 V, 3 Phase, 50 Cycle at 1500 Rpm; Skid Mounted (Detroit Diesel Divn. General Motors Corp. Model 6910A) FSN 6115-798-34444.

6. Painting

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7. Preventive Maintenance

AR 700-38	Unsatisfactory Equipment Report.
AR 750-5	Maintenance Responsibilities and Shop Operation.
TB ENG 347	Winterization Techniques for Engineer Equipment.
TM 5-505	Maintenance of Engineer Equipment.

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DA Pam 310-1	Index of Administrative Publications.
DA Pam 310-2	Index of Blank Forms
DA Pam 310-3	Index of Training Publications.
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
DA Pam 310-5	Index of Graphic Training Aids and Devices.
DA Pam 310-25	Index of Supply Manuals-Corps of Engineers.

9. Radio Interference Surppression

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	416 V, 3 Phase, 60 Cycle, at 1800 Rpm, 83.3 Kw, 120/208 V, 240/416 V, 3 Phase, 50 Cycle at 1500 Rpm; Skid Mounted (Detroit Diesel Divn. General Motors Corp. Model 6910A) FSN 6115-7983444.
TM 5-6115-29335P	Field and Depot Maintenance Repair Parts and Special Tool Lists Generator Set, Diesel Engine: Precise Power; 100 Kw, Ac, 120/208 V, 240/416 V, 3 Phase, 60 Cycle, at 1800 Rpm, 83.3 Kw, 120/208 V, 240/416 V, 3 Phase, 50 Cycle at 1500 Rpm; Skid Mounted (Detroit Diesel Divn. General Motors Corp. Model 6910A) FSN 6115-798-3444.

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FM 21-5	Military Training
FM 21-6	Techniques of Military Instruction.
FM 21-30	Military Symbols

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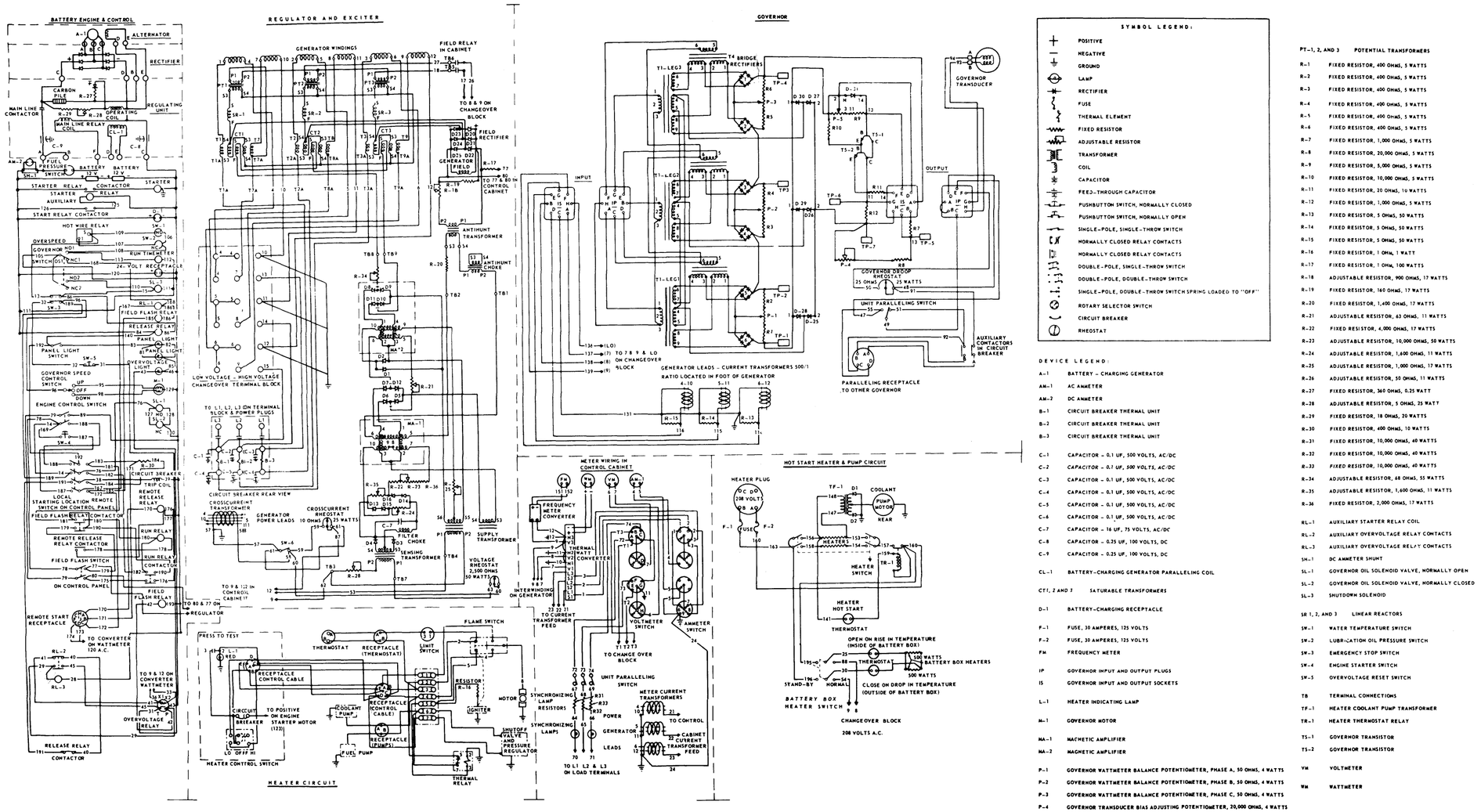

SYMBOL LEGEND:

- POSITIVE
- NEGATIVE
- GROUND
- LAMP
- RECTIFIER
- FUSE
- THERMAL ELEMENT
- FIXED RESISTOR
- ADJUSTABLE RESISTOR
- TRANSFORMER
- COIL
- CAPACITOR
- FEED-THROUGH CAPACITOR
- PUSHBUTTON SWITCH, NORMALLY CLOSED
- PUSHBUTTON SWITCH, NORMALLY OPEN
- SINGLE-POLE, SINGLE-THROW SWITCH
- NORMALLY CLOSED RELAY CONTACTS
- NORMALLY CLOSED RELAY CONTACTS
- DOUBLE-POLE, SINGLE-THROW SWITCH
- DOUBLE-POLE, DOUBLE-THROW SWITCH
- SINGLE-POLE, DOUBLE-THROW SWITCH SPRING LOADED TO "OFF"
- ROTARY SELECTOR SWITCH
- CIRCUIT BREAKER
- RHEOSTAT

DEVICE LEGEND:

A-1 BATTERY - CHARGING GENERATOR
AM-1 AC AMMETER
AM-2 DC AMMETER
B-1 CIRCUIT BREAKER THERMAL UNIT
B-2 CIRCUIT BREAKER THERMAL UNIT
B-3 CIRCUIT BREAKER THERMAL UNIT

C-1 CAPACITOR - 0.1 UF, 500 VOLTS, AC/DC
C-2 CAPACITOR - 0.1 UF, 500 VOLTS, AC/DC
C-3 CAPACITOR - 0.1 UF, 500 VOLTS, AC/DC
C-4 CAPACITOR - 0.1 UF, 500 VOLTS, AC/DC
C-5 CAPACITOR - 0.1 UF, 500 VOLTS, AC/DC
C-6 CAPACITOR - 0.1 UF, 500 VOLTS, AC/DC
C-7 CAPACITOR - 16 UF, 75 VOLTS, AC/DC
C-8 CAPACITOR - 0.25 UF, 100 VOLTS, DC
C-9 CAPACITOR - 0.25 UF, 100 VOLTS, DC

CL-1 BATTERY-CHARGING GENERATOR PARALLELING COIL

CT1, 2 AND 3 SATURABLE TRANSFORMERS

D-1 BATTERY-CHARGING RECEPTACLE

F-1 FUSE, 30 AMPERES, 125 VOLTS
F-2 FUSE, 30 AMPERES, 125 VOLTS
FM FREQUENCY METER

GP GOVERNOR INPUT AND OUTPUT PLUGS
GS GOVERNOR INPUT AND OUTPUT SOCKETS

HL-1 HEATER INDICATING LAMP

M-1 GOVERNOR MOTOR

MA-1 MAGNETIC AMPLIFIER
MA-2 MAGNETIC AMPLIFIER

P-1 GOVERNOR WATTMETER BALANCE POTENTIOMETER, PHASE A, 50 OHMS, 4 WATTS
P-2 GOVERNOR WATTMETER BALANCE POTENTIOMETER, PHASE B, 50 OHMS, 4 WATTS
P-3 GOVERNOR WATTMETER BALANCE POTENTIOMETER, PHASE C, 50 OHMS, 4 WATTS
P-4 GOVERNOR TRANSDUCER BIAS ADJUSTING POTENTIOMETER, 20,000 OHMS, 4 WATTS
P-5 GOVERNOR SENSITIVITY POTENTIOMETER, 20,000 OHMS, 4 WATTS

PT-1, 2, AND 3 POTENTIAL TRANSFORMERS

R-1 FIXED RESISTOR, 400 OHMS, 5 WATTS
R-2 FIXED RESISTOR, 400 OHMS, 5 WATTS
R-3 FIXED RESISTOR, 400 OHMS, 5 WATTS
R-4 FIXED RESISTOR, 400 OHMS, 5 WATTS
R-5 FIXED RESISTOR, 400 OHMS, 5 WATTS
R-6 FIXED RESISTOR, 400 OHMS, 5 WATTS
R-7 FIXED RESISTOR, 1,000 OHMS, 5 WATTS
R-8 FIXED RESISTOR, 20,000 OHMS, 5 WATTS
R-9 FIXED RESISTOR, 5,000 OHMS, 5 WATTS
R-10 FIXED RESISTOR, 10,000 OHMS, 5 WATTS
R-11 FIXED RESISTOR, 20 OHMS, 10 WATTS
R-12 FIXED RESISTOR, 1,000 OHMS, 5 WATTS
R-13 FIXED RESISTOR, 5 OHMS, 50 WATTS
R-14 FIXED RESISTOR, 5 OHMS, 50 WATTS
R-15 FIXED RESISTOR, 5 OHMS, 50 WATTS
R-16 FIXED RESISTOR, 1 OHM, 1 WATT
R-17 FIXED RESISTOR, 1 OHM, 100 WATTS
R-18 ADJUSTABLE RESISTOR, 900 OHMS, 17 WATTS
R-19 FIXED RESISTOR, 160 OHMS, 17 WATTS
R-20 FIXED RESISTOR, 1,400 OHMS, 17 WATTS
R-21 ADJUSTABLE RESISTOR, 62 OHMS, 11 WATTS
R-22 FIXED RESISTOR, 4,000 OHMS, 17 WATTS
R-23 ADJUSTABLE RESISTOR, 10,000 OHMS, 50 WATTS
R-24 ADJUSTABLE RESISTOR, 1,600 OHMS, 11 WATTS
R-25 ADJUSTABLE RESISTOR, 1,000 OHMS, 17 WATTS
R-26 ADJUSTABLE RESISTOR, 50 OHMS, 11 WATTS
R-27 FIXED RESISTOR, 360 OHMS, 0.25 WATT
R-28 ADJUSTABLE RESISTOR, 5 OHMS, 25 WATT
R-29 FIXED RESISTOR, 18 OHMS, 20 WATTS
R-30 FIXED RESISTOR, 400 OHMS, 10 WATTS
R-31 FIXED RESISTOR, 10,000 OHMS, 40 WATTS
R-32 FIXED RESISTOR, 10,000 OHMS, 40 WATTS
R-33 FIXED RESISTOR, 10,000 OHMS, 40 WATTS
R-34 ADJUSTABLE RESISTOR, 68 OHMS, 55 WATTS
R-35 ADJUSTABLE RESISTOR, 1,600 OHMS, 11 WATTS
R-36 FIXED RESISTOR, 2,000 OHMS, 17 WATTS

RL-1 AUXILIARY STARTER RELAY COIL
RL-2 AUXILIARY OVERVOLTAGE RELAY CONTACTS
RL-3 AUXILIARY OVERVOLTAGE RELAY CONTACTS
SH-1 DC AMMETER SHUNT
SL-1 GOVERNOR OIL SOLENOID VALVE, NORMALLY OPEN
SL-2 GOVERNOR OIL SOLENOID VALVE, NORMALLY CLOSED
SL-3 SHUTDOWN SOLENOID

SR 1, 2, AND 3 LINEAR REACTORS

SW-1 WATER TEMPERATURE SWITCH
SW-2 LUBRICATION OIL PRESSURE SWITCH
SW-3 EMERGENCY STOP SWITCH
SW-4 ENGINE STARTER SWITCH
SW-5 OVERVOLTAGE RESET SWITCH

TB TERMINAL CONNECTIONS
TF-1 HEATER COOLANT PUMP TRANSFORMER
TR-1 HEATER THERMOSTAT RELAY
TS-1 GOVERNOR TRANSISTOR
TS-2 GOVERNOR TRANSISTOR

VM VOLTMETER

WM WATTMETER

EMC 6115-293-35/1

Figure 1. Schematic wiring diagram.

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